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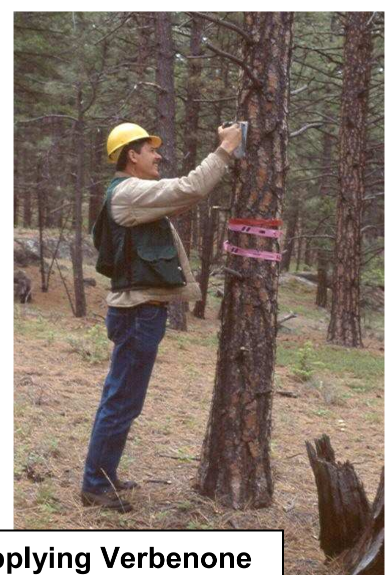
MONTANA FOREST INSECT AND DISEASE CONDITIONS AND PROGRAM HIGHLIGHTS

2005

Elytroderma Broom



Applying Verbenone Pouch on Ponderosa Pine

MONTANA

Forest Insect and Disease Conditions and Program Highlights - 2005

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Compiled By:

Larry Meyer, USDA Forest Service, Northern Region, State and Private Forestry, Forest Health Protection

Contributors:

Leah Chapman, Gregg DeNitto, Ken Gibson, Marcus Jackson, John Schwandt, Sandy Kegley, Blakey Lockman, Nancy Sturdevant, USDA Forest Service, Northern Region, State and Private Forestry, Forest Health Protection; Brennan Ferguson, Amy Kearney, Montana Department of Natural Resources and Conservation, Forestry Division

Data Summary and Map Production:

Jim Fears, USDA Forest Service, Northern Region, State and Private Forestry, Forest Health Protection

Cover Photo:

Elytroderma broom, archives, USDA Forest Service.

Applying verbenone pouch on ponderosa pine, courtesy of Ken Gibson, USDA Forest Service.

Text Edits:

Laura Dunning, USDA Forest Service, Northern Region, State and Private Forestry, Forest Health Protection

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INTRODUCTION

This report summarizes the major forest insect and disease conditions in Montana during 2005 and was jointly prepared by the Montana Department of Natural Resources and Conservation, Forestry Division and USDA Forest Service (FS), Forest Health Protection (FHP), State and Private Forestry, Northern Region. Information for the report was derived from ground and aerial surveys within Reporting Areas across parts of Montana. A Reporting Area (RA) includes all federal, state, and private land ownerships within a particular geographic boundary (Figure 1).

SUMMARY OF CONDITIONS

Bark Beetles

In both 2004 and 2005, western Montana received normal or slightly higher amounts of precipitation. Most of the State, with the exception of southeastern portion, showed improved growing conditions for most bark beetle hosts over the past couple of years. Still, long-term drought affects are not easily overcome. Many bark beetle species remained at extremely high levels and showed only slight response to improved host conditions in 2005. As a result of at least somewhat-improved conditions, infested areas recorded for some bark beetle species—notable exceptions being mountain pine beetle and Douglas-fir beetle—declined in 2005. Fortunately, mostly-optimal weather conditions permitted aerial survey of nearly all beetle-infested areas, for the first time since 2002. Approximately 90% of the forested portions of the reporting areas were flown. For most of the State, ground-collected data showed decreasing bark beetle populations for most species, except mountain pine beetle.

Mountain pine beetle-infested areas increased in many locations surveyed; however, in some locations, intensity of beetle-caused mortality is declining due to host depletion. Decreases, at least in intensity, were noted in infested areas recorded on Lolo and Deerlodge National Forests (NF), despite little reduction in total acres affected. In total, considerably more infested acres were recorded in 2005 than in 2004. Much of that total infested area was recorded in whitebark pine stands, where outbreak extent and intensity increased significantly. For the first time in a couple of years, we have a relatively accurate measure of total infested area, throughout the State.

Douglas-fir beetle-infested acres actually increased in much of western Montana. At a few locations in southwestern and central Montana, populations remained at outbreak levels. While infested acres increased in 2005, that was a reflection of trees killed in 2004. Ground surveys indicated beetle activity subsided in most areas. Grand fir mortality attributable to fir engraver decreased from all-time high levels recorded in 2004; but western balsam bark beetle-killed subalpine fir was mapped on more acres than last year. Looking forward to 2005, we are hopeful of continuing the recovery from droughty conditions of the past several years. With continued near-normal weather, we are cautiously optimistic we may see bark beetle populations begin to decrease in intensity, and even extent. Should we have a departure from normal amounts of moisture received this fall, and an unusually dry spring, we could see a resurgence of bark beetle activity in the coming year.

Defoliators

Acres of defoliation are continuing to increase across many reporting areas in Montana. In 2005, a total of 454,176 acres were mapped as defoliated as compared to 187,000 acres defoliated in 2004. Western spruce budworm continues to be the primary insect responsible for the vast majority of the defoliation. Defoliation from Douglas-fir tussock moth was apparent along the western shore of Flathead Lake between Jette Lake and Somers.

Populations at all other historical tussock moth locations have virtually collapsed with corresponding low to non-existent pheromone trap catches. Aerial survey recorded 306 acres of defoliation in the north-western part of the state by an insect that we have not identified to date. Other defoliators such as larch bud moth were infrequent and did not cause significant defoliation or damage.

Root Diseases

Mortality and growth losses from root disease continue to be high throughout the state. Root disease-caused mortality is more common west of the Continental Divide, causing mortality on over one million acres. Large areas of root disease can be found east of the Divide but they tend to be found in more discreet patches, rather than being ubiquitous throughout an area. Also, root diseases are commonly found in riparian areas east of the Continental Divide, often in spruce and subalpine fir.

Foliage Diseases

Aerial detection surveys reported nearly 17,000 acres of forest land affected by foliage diseases. Lodgepole pine needlecast was responsible for more than half of those acres and larch needle problems (needlecast, needleblight, and casebearer) accounted for more than one-third of the acres. Elytroderma needle disease was reported on 340 acres.

Dwarf Mistletoes

Pre-suppression surveys for lodgepole pine dwarf mistletoe on the Blackfeet Indian Reservation found less than 5% of 30-year-old lodgepole pine regeneration, within 30 feet of an infected overstory, were visibly infected with dwarf mistletoe. Previous research suggests that about 35% of these trees should have been infected.

White Pine Blister Rust

Forest Health Protection, in cooperation with partners, provides annual training pertaining to pruning of western white pine and management of rust-resistant western white pine in the Inland Empire. In addition, a range-wide database to compile limber pine and whitebark pine survey results is under development.

ANNUAL AERIAL SURVEY

The annual aerial detection survey in Montana was conducted from June 27th thru September 22nd, 2005. The survey covered approximately 29.7 million acres of mixed ownership forestlands, excluding most wilderness areas (Figure 2). Four FHP sketch mappers, using three different airplanes, conducted the 2005 aerial survey.

Favorable flying conditions allowed for approximately 7 million more acres to be surveyed in Montana in 2005 than in 2004.

Much of the data summarized in this report is a product of the aerial survey, as well as ground surveys and biological evaluations. Along with the data summaries, aerial survey maps are available from the Missoula FHP Field Office, in both paper and digitized GIS format.

The annual aerial detection survey is an overview survey designed to cover large areas in relatively short periods. Aerially detected signatures include tree mortality, defoliation and windthrow. If forest disturbance activities are low, secondary disturbances such as diseases, needle casts, high-water damage and previous fire damage are sketch mapped. The intent of the survey is to cover each area once a year during which time the observer sketch maps as many disturbances and damage as possible. The survey is conducted using single-engine, high-wing airplanes, flying at speeds of approximately 90 to 130 mph, at an average altitude of approximately 1,000 to 2,000 feet above ground level.

The aerial survey data are estimates made from airplanes and though not as many areas were ground checked as we would like, enough were checked to lend confidence to the areas for which we only

have aerial survey data. Together, aerial and ground surveys provide information relative to bark-beetle-caused mortality, as well as other damage agents pertinent to land managers charged with the responsibility of maintaining forest health.

INSECTS

Abbreviations

The following abbreviations are used throughout the bark beetle section:

Beetles	DFB	=	Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopkins
	ESB	=	Spruce beetle, D. *rufipennis* (Kirby)
	IPS	=	Pine engraver, *Ips pini* (Say)
	MPB	=	Mountain pine beetle, *D. ponderosae* Hopkins
	WPB	=	Western pine beetle, *D. brevicomis* LeConte
	FE	=	Fir engraver, *Scolytus ventralis* LeConte
	WBBB	=	Western balsam bark beetle, *Dryocoetes confuses* Swaine
	RTB	=	Red turpentine beetle, *D. valens* LeConte
Hosts	LPP	=	Lodgepole pine
	PP	=	Ponderosa pine
	WWP	=	Western white pine
	WBP	=	Whitebark pine
	DF	=	Douglas-fir
	GF	=	Grand fir
	SAF	=	Subalpine fir
	ES	=	Engelmann spruce
Other	NF	=	National Forest
	RD	=	Ranger District
	IR	=	Indian Reservation
	NP	=	National Park
	BLM	=	Bureau of Land Management

Reporting Area summaries follow. For each, bark beetle effects on their respective hosts are noted. To the extent possible, we have indicated areas affected, an estimate of impacts, and beetle population trends. Though reporting areas are typically designated by names of National Forests, Indian Reservations, or National Parks; there may be within those reporting areas, lands of various ownerships—federal, state and private.

BARK BEETLE CONDITIONS BY REPORTING AREA IN BRIEF

Mountain Pine Beetle (MPB). The infested area mapped in 2005 increased significantly in many parts of the State. In western Montana, most reporting areas showed an increase in infested areas. Lolo NF reporting area showed an exceptional increase; however, some of the most heavily infested areas were not flown in 2004, so direct comparisons to 2005 figures were not meaningful. On Deerlodge and Flathead NFs, where most affected areas were flown both years, infested area increased once again. Acres on which beetle-caused mortality was recorded, in all species and on all ownerships, increased considerably, to more than 820,400 acres—the highest total since 1984. Slightly more than 453,000 acres had been recorded in 2004. On those infested acres in 2005, more than 2.8 million trees were killed in 2004—recorded as faders this year. Almost 90% of those were lodgepole pine. Although beginning to decline in some host stands, beetle populations continued to expand in many areas. As many as 90 new attacks per acre (in lodgepole pine) were found in one area surveyed.

A significant increase in beetle-caused mortality was noted in whitebark pine stands—especially on Gallatin, Helena, and Beaverhead NFs and in Yellowstone National Park (NP). Ground observations in some areas confirmed that many of those infestations are still expanding. MPB infested more than 105,000 acres of whitebark pine stands in State reporting areas, and another 29,200 acres in Yellowstone NP. In some stands, as many as 220 trees per acre have been killed within the past 2-4 years.

Many susceptible lodgepole, whitebark, and ponderosa pine stands remain in the State. Unless weather patterns change to ones more favorable to their host and less conducive to beetle survival and population expansion, or management activities reduce availability of susceptible hosts, MPB populations and resultant tree mortality will continue until few susceptible hosts remain in many stands.

Douglas-fir Beetle (DFB). In western Montana, most infested stands in the northwestern part of the State showed static or declining populations; however, a marked increase was noted on the Flathead NF. In many areas, beetle-killed trees were still obvious; but seldom did we find higher numbers of new attacks in 2005. A notable exception was found in northwestern Glacier NP, where two heavily infested stands were found. Stands surveyed in and around areas affected by 2000 fires, on parts of Bitterroot and Helena NFs, showed populations beginning to decline. Few areas had more new attacks in 2005 than in 2004. Infested area recorded on aerial detection surveys declined on the Helena NF, from 18,800 acres in 2004 to slightly less than 5,560 acres in 2005. On the Bitterroot NF, where beetles have infested stands not affected by fire, infested area increased from 31,000 acres in 2004 to almost 70,000 acres in 2005—still the most heavily impacted reporting area in the Region. Ground surveys and observations showed fewer areas with high amounts of currently infested trees, so we believe the infestation has begun to decline. Surveys conducted on Deerlodge and Lolo NFs showed significant increases in infested areas. On the Gallatin NF, populations remained high in some stands, and overall, more acres were recorded in 2004 than in 2005. Later-than-normal attacks found on the Gallatin NF in October 2004 resulted in

little tree mortality. Spring surveys indicated few of those late-season attacks were successful.

State-wide, the infested area mapped increased to more than 168,400 acres; up from 92,500 acres in 2004. In some stands, particularly on Bitterroot, Lolo, Deerlodge, and Gallatin NFs, populations may be still increasing. In some areas, increases may be more perceived than real. It is often difficult to separate year of kill from the air.

In some areas of western Montana, small-diameter Douglas-fir have been killed during the past 2-3 years, with damage attributed to DFB. Ground observations have shown that many of those, in 6- to 10-inch diameter classes, have in fact been killed by Douglas-fir pole beetles (*Pseudohylesinus nebulosus* [LeConte]), the flatheaded fir borer (*Melanophila drummondi* [Kirby]), or combinations of both. Both beetles respond to drought-stressed trees. In addition, many smaller-diameter western larch have also been recently killed by flatheaded fir borers. We expect those occurrences to decline with improving moisture conditions.

More than 1 million acres of Douglas-fir, older than 100 years, exist in the Region. Weather and stand disturbances—fire, defoliation, or wind throw—increase the likelihood of DFB outbreaks in susceptible stands. Preventive management is the key to reducing outbreak potential.

Fir Engraver (FE). Grand fir stands, in which FE-caused mortality was recorded, increased to an all-time high throughout the Region in 2004. Improved weather over the past two years has resulted in significant decreases in infested area in 2005 in most of the Region, but a modest increase in northwestern Montana. Most mixed-species stands in which grand fir was a component, western Montana, showed on slightly elevated levels of infestation this year. Total infested area exceeded 34,400 acres in 2004, and increased to 38,500 acres in 2005. Nearly 58,000 grand fir were estimated to have been killed in 2004 (recorded as faders in 2005). We believe these nearly static levels of FE-caused mortality were a result of better precipitation in both the past two years. Should we continue on this nearly-normal trend, populations should begin to decline in 2006.

Western Balsam Bark Beetle (WBBB). The number of acres on which subalpine fir mortality, attributed to WBBB, were recorded once again increased in 2005; but that could be a reflection of more areas surveyed in 2005 than an actual increase in beetle activity. Several Forests, where beetle populations have recently been high, were not flown in 2004. In the areas surveyed, in 2004, more than 133,800 infested acres were reported. That figure increased to 208,500 acres in 2005. An estimated 353,900 subalpine fir were killed. The Beaverhead NF, in southwestern Montana, harbored the most widespread outbreaks where nearly 82,000 infested acres were reported. In many areas, populations may still be increasing, but should soon respond to improved weather conditions

Others. Pine engraver beetle (IPS) populations, and associated tree mortality decreased substantially in ponderosa pine stands in the State, but most of those decreases resulted from none being mapped on the Flathead Indian Reservation (IR) in western Montana. More than 14,000 acres had been recorded in 2004. Elsewhere, populations were static or increased somewhat. Notable increases were recorded on Custer and Bitterroot NFs and Northern Cheyenne IR in Montana. In total, about 12,500 infested acres were recorded; compared to a little more than 17,000 acres in 2004.

Spruce beetle (ESB) populations remained at endemic levels Montana. In no reporting area were more than 100 infested acres recorded. The outbreak recorded east of Yellowstone Lake in Yellowstone NP, mapped at more than 8,700 acres in 2003 now covers less that 2,000 acres. That outbreak has declined significantly.

Western pine beetle (WPB)-caused mortality, still relatively low for stand conditions, increased in 2005, to about 1,700 acres. About 400 acres had been reported in 2004. Almost half of those acres were reported on the Pintler RD of the Deerlodge NF, but mortality was very lightly scattered throughout. An estimated 250 PP were killed. We anticipate continuing declines if precipitation patterns approach normal conditions.

BARK BEETLE CONDITIONS BY REPORTING AREA

Beaverhead Reporting Area

Dillon RD. Large amounts of MPB-killed WBP and LPP were recorded in the southern portion of Snowcrest Range. A few groups of WBBB-killed SAF and widely scattered DF, killed by DFB, were noted in that same general area. Lesser amounts of each were more generally scattered in the Blacktail Mountains south of Dillon.

To the south, in the Tendoy Mountains, widely scattered groups of WBBB and MPB-killed LPP were observed. South and west of Dillon, from Lemhi Pass to Bannock Pass, scattered groups SAF, were infested by WBBB. In a more general pattern, from Jeff Davis Peak, south to Morrison Lake, scattered WBBB-killed SAF and minor amounts of DFB-killed DF were noted. There were, in that same area, a few small groups of MPB-infested LPP and WBP recorded.

District-wide, 4,000 DFB-killed DF were recorded on about 1,800 acres; MPB-killed 6,100 LPP on almost 3,400 acres and 1,200 WBP on nearly 600 acres; and almost 10,000 SAF were killed by WBBB on 4,700 acres.

Wise River RD. Small and lightly scattered groups of MPB-killed LPP were recorded in East Pioneer Mountains. Most were located south of Big Hole River. North of Big Hole River, from about Patton Spring to Fleecer Ridge, large groups of DFB-killed DF were also noted. In that same area, DF stands have also been heavily infested by western spruce budworm, *Choristoneura occidentalis*, Freeman (WSBW). Defoliation coupled with abnormally dry weather could result in increased DFB activity.

For the areas surveyed, DFB-caused mortality was observed on almost 6,600 acres, where 7,100 DF were killed; 7,000 SAF were killed by WBBB on nearly 4,700 acres; and 5,300 LPP were killed on 3,900 acres by MPB. Lesser amounts of mortality were recorded on adjacent State and private lands.

Wisdom RD. There was much widely scattered beetle activity recorded throughout the Pioneer Mountains. Small groups of DFB-killed DF were concentrated in the north, with largest groups northwest of Wise River, and south towards Table Mountain. Significant amounts of WBBB-caused mortality and MPB-infested LPP were scattered throughout the District.

In the Beaverhead Mountains, west of Wisdom, many widely scattered, but generally smaller groups of SAF killed by WBBB and LPP infested by MPB were noted. DFB activity was also occasionally observed there, but that was down from the past several years. In the Anaconda Range to the north, larger groups of WBBB-killed SAF and MPB-killed LPP were mapped. Some of the larger groups of the former were near Mud Lake; the latter in the LaMarche Creek drainage.

Notable concentrations of WBBB activity, within the past few years mapped in the Ruby Creek drainage, west of Wisdom; and in the Beaver Creek and Thompson Creek drainages in the Anaconda Range to the north seems to have declined somewhat.

Area-wide, almost 13,000 DF were killed by DFB on 5,750 acres; 4,700 LPP by MPB on 2,900 acres; and WBBB killed just over 8,000 SAF on 4,800 acres.

Madison RD. Widely dispersed small groups, intermixed with a few larger ones, of WBBB-infested SAF were noted in the Madison Range. In that same area, small and very lightly scattered groups of MPB-killed LPP and WBP were also observed. Small amounts DFB-killed DF were mapped in a few DF stands.

Throughout the Tobacco Root Mountains, large numbers of SAF, killed by WBBB, were found. Some groups were quite large—up to 5 trees per acre, covering several hundred acres each. Considerable amounts of MPB-killed LPP were observed in the northwestern part of the Tobacco Roots, from Meadow Creek north to Carmichael Creek. Noticeable increases in WSBW activity could result in increases of DFB populations. Those populations are now fairly low.

In the Gravelly Range to the south, still large amounts of WBBB-killed SAF were observed; but generally at lower levels than in previous years. Highest concentrations were noted in and around Morgan Gulch. Also throughout the Range, MPB activity in LPP stands increased significantly. Especially noticeable were groups of beetle-killed LPP near Baldy Mountain and south towards Wade and Cliff Lakes. Significant amounts of MPB-killed WBP, often in conjunction with white pine blister rust (BR), were recorded in the Gravellies as well. Some of those groups covered several thousand acres each.

In the Snowcrest Mountains southwest of Ennis, many large groups of WBBB-killed SAF, and MPB-infested LPP and WBP were mapped. WBP was also being affected by BR. In addition, significant amounts of MPB-killed WBP were noted in the Ruby Mountains, east of Dillon.

In the past couple of years, SAF mortality attributed to WBBB had reached extremely high levels throughout the District. Some stands were more heavily impacted than others, but it appeared there were few SAF stands on the District not affected to some extent. Relatively small groups—up to 100 trees each—were reported in the Tobacco Root Mountains to the north. To the south, throughout the Gravelly Range, extremely large groups of faders—covering as much as several thousand acres each, and averaging an estimated 3-5 trees per acre—were mapped within the past couple of years. That activity remained relatively static.

In 2004, the largest concentrations of WBBB-killed trees were mapped south and west of Ennis in the Ruby Range, throughout the Snowcrest Range, and southern end of the Gravelly Range. Total affected area on the District was estimated at 9,700 acres on which an estimated 10,700 trees were killed. In 2005, those aerial survey estimates totaled more than 75,000 SAF killed on 30,200 acres. More than 58,000 WBP and another 20,300 LPP were killed by MPB on 30,200 acres and 13,000 acres, respectively. DFB killed about one tree per acre on 4,700 acres.

To the south, in the Centennial Range, on lands administered mostly by BLM, large amounts of SAF, killed by WBBB, were still present, but decreased from 2004 levels. In that same general area, significant amounts of LPP killed by MPB were recorded, with lesser amounts of WBP having been infested by MPB. Larger groups of SAF faders were noted west of Nemesis Mountain, then west of Baldy Mountain. WBBB killed about 13,800 trees on 8,900 acres. Most MPB-caused mortality was also west of Nemesis Mountain and totaled 27,000 LPP on 14,200 acres; and 30,200 WBP on 4,800 acres. Small amounts of DFB activity were observed at a few lower-elevation sites.

Total aerial survey estimates for the Beaverhead RA, on lands of all ownerships, showed nearly 23,500 acres infested by DFB; 92,900 acres infested by MPB (all hosts); and almost 82,000 acres infested by WBBB. Approximately 424,000 trees were killed by bark beetles throughout the area in 2004, recorded as faders in 2005. In

addition, nearly 61,000 acres showed some level of WSBW defoliation. Dependent upon weather over the next few years, many of those trees could be killed by.

Bitterroot Reporting Area

Stevensville RD. Large areas of widely scattered LPP killed by MPB were mapped in the Sapphire Mountains northeast of Stevensville, between Threemile Point and Cleveland Mountain. From there, southward towards Owen Point, in the Sapphire Range, smaller and more thinly dispersed groups of MPB-killed LPP were found. In that same general area, minor amounts DFB-infested DF were noted. From Owen Point, south to Skalkaho Creek observers recorded larger groups of MPB-killed LPP, WBBB-infested SAF, and DF impacted by DFB. Significant groups of MPB-killed WBP were also noted in that vicinity. In the Bitterroot Range to the west, only very light and widely distributed bark beetle activity was found.

District totals, up from those mapped in 2004 showed about 1,800 acres of DFB-infested DF; and a marked increased of MPB-caused mortality—14,000 LPP on approximately 7,000 acres; another 3,000 WBP on 3,700 acres. More than 6,300 acres were affected by WBBB, on which 11,100 SAF were killed.

Darby RD. South of Skalkaho Creek, still-large groups DFB-killed DF were mapped. Most were east of Black Bear Point. West of there, smaller groups DFB-infested trees were observed; however more-significant groups of MPB-killed LPP and lesser amounts PP were also noted. Small amounts of WBBB activity and a few PP killed by IPS were reported. To the west, north of Lake Como, a few large groups MPB-infested LPP, DFB- and WBBB-killed trees were located. South of Lake Como, several large groups DFB-infested DF were mapped closer to the Bitterroot River.

District-wide, DFB-infested acres increased significantly in 2005, to more than 12,700 acres, on which 28,000 DF had been killed. MPB activity also increased: 4,500 LPP were killed on 3,200 acres; and 5,700 WBP on 3,400 acres. Almost 10,200 SAF were killed on 6,800 acres. Minor amounts of other bark beetle-related mortality were occasionally observed.

Sula RD. Many very large groups of DFB-killed DF were recorded at various locations on the District. While ground observations suggest beetle populations are declining, there were actually more and larger groups recorded this year than in 2004. Largest groups were mapped throughout East Fork Bitterroot River drainage, from Montana Prince Mine to Ross Hole. Some of those groups covered a few thousand acres and averaged 3-5 trees per acre.

On the western side of the District, from Saddle Mountain, north to West Fork Bitterroot River, numerous large groups of DFB-killed faders were reported. In that part of the District, a few smaller groups of MPB-killed LPP and WBBB-killed SAF were also noted.

Total area infested by DFB increased to slightly more than 26,000 acres. Just over 12,000 acres had been recorded in 2004. Approximately 60,000 DF were killed on those infested acres.

Also on the District several groups of LPP, killed by MPB and totaling 700 acres, were recorded. At higher elevations, SAF stands generally contained a few larger groups of WBBB-killed trees; totaling about 8,100 trees on 5,400 acres.

West Fork RD. In 2005, we still recorded many large groups of DFB-affected DF throughout the non-wilderness part of District. Largest groups were noted from Hughes Creek north to Beavertail Creek. Other large groups were well-scattered throughout Nez Perce Fork Bitterroot River drainage. Lesser amounts of WBBB-killed SAF and MPB-killed trees, in both LPP and PP stands, were found at various sites throughout the reporting area. In the

southwest part of District, near the Idaho/Montana border, several larger groups of SAF, killed by WBBB, were seen.

District-wide, DFB infested more than 28,000 acres and killed more than 49,000 DF. MPB accounted for 2,300 dead LPP on 1,300 acres; and WBBB killed approximately 11,000 SAF on 7,500 acres.

Following the fires of 2000, a significant increase in beetle-infested stands not affected by fire, has been observed throughout the southern portion of the Bitterroot NF. Ground surveys conducted in the past several years showed many fire-damaged trees were infested in 2001, but many more non-damaged trees were attacked in 2002 and 2003. Surveys conducted in fire-affected and adjacent stands in 2004, showed generally declining numbers of new attacks, although numerous new attacks per acre were observed in some areas. That trend continued in 2005. In some areas, host depletion suggests beetle populations were beginning to decline.

Bitterroot RA totals for 2005 showed 69,300 acres infested by DFB, on which nearly 143,000 DF were killed. Only 31,000 acres had been infested in 2004. Slightly more than 12,700 acres LPP; 7,200 acres WBP; and about 500 acres PP contained varying amounts of MPB-caused mortality. About 33,000 MPB hosts were killed. Just over 26,000 acres of SAF stands were infested by WBBB, on which 40,400 SAF were killed. Morality attributed to other bark beetles was less significant.

Custer Reporting Area

Beartooth RD. In the Pryor Mountains a few large groups DFB-killed DF were mapped, especially near Mystery Cave and along Commissary Ridge. Small amounts MPB-killed LP, plus significant amounts SAF, infested by WBBB, were lightly scattered throughout the area surveyed. West of Red Lodge, and north of Cooke City, several large groups of WBBB-killed SAF were mapped in upper reaches of Castle Creek, Picket Pin Creek, and Iron Creek.

Significant amounts of MPB-caused mortality in LP stands were mapped generally west of Red Pryor Mountain. Infested stands were also noted on lands administered by BLM in that area.

More than 2,100 acres DF; 3,400 acres SAF; 1,100 acres WBP, and 730 acres LPP contained measurable amounts of bark beetle-caused mortality, District-wide. Nearly 12,000 trees were killed.

Sioux RD. Minor amounts of MPB- and IPS-killed trees were very widely distributed in PP stands in the North and South Cave Hills, east of Camp Crook; and in the Slim Buttes, east of Buffalo, South Dakota. Southeast of Camp Crook, minor amounts of mostly IPS-killed PP were found in the Short Pine Hills. More widely scattered, but still mostly small groups of IPS-killed PP were mapped throughout Chalk Buttes, Ekalaka Hills, and Long Pines.

MPB killed an approximate 70 PP and IPS another 1,100 trees on a combined 1,300 acres, District-wide.

Ashland RD. Very sparsely scattered, small groups of IPS- and MPB-killed PP were noted east of Ashland. IPS-caused damage was the more commonly encountered, but MPB-killed trees were widely observed as well. No significantly large groups were reported, but some of the larger ones were found north and west of Sayler.

Throughout the District, beetles killed about 12,000 PP on a combined 5,300 acres. Only 2,600 infested acres were reported in 2004.

Custer RA-wide, reported bark beetle-caused mortality totaled 3,900 DF killed by DFB on 4,300 acres. MPB was attributed with killing 500 LP on 320 acres; 400 PP on 600 acres, 760 LPP on 740 acres; and 1,340 WBP on 1,100 acres. And an

estimated 8,300 WBBB-killed SAF on were reported on 4,300 acres. Most of those were increases over 2004 levels.

Deerlodge Reporting Area

Butte RD. MPB-caused mortality in LPP stands increased in both extent and intensity in 2005, throughout the District. Populations are decreasing in some stands, such as those located in Thompson Park and Basin Creek; but are expanding markedly in others, as in those found in American Gulch and near Fleecer Mountain. Beetle-killed groups, extending for several thousand acres each and varying in intensity from 3 to 15 trees per acre were generally recorded in most LPP stands in every direction, centered on Butte. Most intensely affected stands were mapped near Delmoe Lake, China Gulch, Hanson Gulch and Browns Gulch. Small amounts of DFB-killed DF were also noted, but were nearly inconsequential when compared to MPB activity. With warmer and drier conditions, however, DFB populations could increase in response to increasing amounts of WSBW-caused defoliation.

Ground surveys conducted there showed the infestation in that area is still quite active although decreasing in some areas due to host depletion. In the Lime Kiln area, new attacks, for one 10-plot area, averaged 42 per acre in 2004. That had increased to 72 per acre in 2005. Total for the area was 121 trees per acre killed over the past three years. In Basin Creek, ten plots revealed very few new attacks averaged 16 per acre, but a total of 130 trees per acre during the past 3-4 years. In the American Gulch area, where outbreaks are fairly recent, an average 72 trees per acre have been killed in the past 2 years.

District-wide, an estimated 264,000 LPP were killed on approximately 69,800 acres in the last year. Those estimates represent increases in infested area, but less intensive outbreaks from 2004 when more than 800,000 LPP were killed on about 55,000 acres. Some outbreaks became less intensive as a result of host depletion.

DFB-killed DF was noted in slightly increasing amounts throughout the DF type on the District. District-wide, DFB-caused mortality totaled 1,100 trees on 450 acres.

Jefferson RD. MPB-killed LPP increased once again in most stands on the District. Especially noticeable were large beetle-killed groups between Whitetail Reservoir and Boulder. MPB populations also appeared to be building in the Bull Mountains, south of Boulder; and near Sourdough Mountain east of Boulder. In northern Tobacco Root Mountains, MPB-infested LPP stands were more numerous as well in 2005.

Infestations on the District were not quite as extensive as those on Butte RD, but increased significantly in 2005. Infested area on the District recorded as 75,000 acres in 2005. An estimated 216,000 LPP were killed. WBBB killed about 1,900 SAF on 950 acres.

North of Boulder, on lands administered by both BLM and FS, MPB had killed numerous groups of PP and a few groups of LPP. Beetle populations there did not increase significantly.

Deer Lodge RD. MPB activity in LPP stands increased east of Deer Lodge, especially near Sugarloaf Mountain, Black Mountain, and Orofino Mountain. West of Deerlodge, significant MPB-caused mortality in LPP stands was noted from Cup Lake, south nearly to Anaconda. Minor amounts of DFB-killed DF were noted in that general area as well.

MPB outbreaks on the District totaled about 12,400 acres in 2005. Approximately 22,000 LPP were killed. Only 3,600 acres had been recorded in 2004. DFB- and WBBB-caused mortality was much less significant—found on about 550 and 250 acres, respectively.

Pintler RD. MPB-killed LPP once again increased in 2005—although not drastically—from Anaconda to Georgetown Lake, and into the upper reaches of Rock Creek. More notable than MPB, however, were large amounts of DFB-killed DF still found throughout the western portion of the District. That activity, thought to be declining, was especially prevalent in the upper Rock Creek drainage and its tributaries. Large groups of DFB-killed DF were found near East Fork Reservoir, Moose Meadows, Silver King Mine, and northward into the Harvey Creek drainage. While there seems to have been a general decline in currently infested trees, DFB populations remain unusually high in many DF stands on the District. At higher elevations, SAF stands were impacted by WBBB, but were nearly insignificant when compared to DFB-caused mortality. Along the Clark Fork River, WPB-killed PP was noted, but in very widely scattered and light amounts.

DFB killed about 32,000 DF on almost 15,000 acres. MPB accounted for 5,100 dead LPP and another 370 PP on a combined 3,700 acres. WPB was activity noted on 1,500 acres.

For Deerlodge RA, MPB-infested LPP stands were found on more than 182,200 acres in 2005. Only 108,000 acres had been reported in 2004 and 31,000 acres in 2003. More than half a million LPP were killed last year, alone. Most infested LPP stands were on FS-administered lands. DFB infested another 20,400 acre (8,200 acres in 2004) and WBBB was recorded on 6,300 acres (4,000 in 2004).

Flathead Reporting Area

Swan Lake RD. Significant increases in MPB-killed LPP were noted throughout the Swan Valley. Notably large groups were mapped west of Swan River south of Swan Lake on Swan River South Fork; and in North Fork Cedar Creek drainage, near Hemlock Point, south to Lindbergh Lake and in upper Swan River drainage near Pasture Lake.

To the east, in the Swan Range, MPB-killed trees were common in LPP and WBP stands from Goat Creek on the north to Pierce Lake on the south. Largest groups were mapped south of Lion Creek and just south of Holland Lake.

FE activity in mixed-species stands has declined somewhat but is still extensive in some stands north and east of Swan Lake. Very large, lightly infested (0.5-1 tree per acre) areas were mapped to the north, east, and south of Mud Lake. A few smaller groups were noted south of Swan Lake. DFB activity has declined, but a few beetle-killed groups of DF were found scattered throughout the Swan Range.

In the “Island Unit,” significant increases in MPB-infested LPP were recorded near Blacktail Mountain. FE activity has declined in that same general area, as well. Generally, throughout that part of the District, there has been a marked increase in MPB activity. DFB-killed DF, and WBBB-infested SAF were recorded in a lightly scattered pattern throughout that part of the District.

Mixed-species stands of GF still contained noticeable amounts of FE-killed trees. More than 16,000 GF were killed on 7,500 acres. That was an increase from 2004, but not all the District was flown last year. MPB activity in LPP increased sharply—to 31,000 acres on which 63,000 trees were killed. Throughout the District, DFB killed 7,400 trees on about 3,400 acres. More than 7,500 SAF were killed on 4,400 acres.

Spotted Bear RD. A few large groups MPB-killed LPP remained at some locations, but were much reduced from the past few years, both in extent and intensity. Large groups were mapped along Bruce Ridge, near Chipmunk Peak, and surrounding Meadow Creek Landing Strip; however, those averaged only about 0.5 trees per acre killed in 2004 (recorded as faders in 2005). Other groups were noted near Big Bull Mountain and in the upper reaches of Spotted Bear River and Dean

Creek drainages. Noticeable amounts of WBBB-killed SAF were noted in high-elevation stands west of Hungry Horse Reservoir, especially near Three Eagles Mountain and Battery Mountain. A few similar groups were also mapped east of the Reservoir, near Mount Baptiste and Circus Peak. DFB activity was only lightly scattered throughout the reporting area.

A set of 30, variable-radius plots that have been monitored yearly for the past 26 years, in the Cedar Creek area, south of Spotted Bear, showed an average 63 LPP per acre have been killed by MPB—mostly within the past 6-8 years.

District-wide, MPB infested LPP stands totaled 11,100 acres, on which almost 18,000 trees were killed. About 8,000 acres were recorded in 2004. DFB-affected stands on the District totaled just over 1,000 acres. Slightly more than 1,700 DF were killed. Only 200 acres had been reported in 2004.

Hungry Horse/Glacier View RD. A variety of bark beetle activity—trees killed by MPB, DFB, and FE—was noted in a generally lightly scattered pattern west of Hungry Horse Reservoir. None was of major significance. A few larger groups of SAF, killed by WBBB, were observed near Hash Mountain. North and east of the Reservoir, bark beetle activity was more prevalent. DFB remained active on Coram Experimental Forest near Martin City, though at levels reduced from previous years. WBBB-killed trees were very widely scattered throughout the Flathead Range, south to the District boundary.

MPB-infested LPP were found in large, though lightly infested groups in the southeastern portion of the District (Great Bear Wilderness). Largest of those groups were found northwest of Nimrod and throughout Middle Fork Flathead River drainage and its tributaries, south of John F. Stevens Canyon. Very large groups were mapped east of Snowslip, along Patrol Ridge, and near Red Plume Mountain. Elsewhere, MPB-killed LPP was found in small groups generally scattered throughout the reporting area.

In 2005, MPB killed a reported 13,100 LPP and 80 WBP—both figures down from 35,000 LPP and 400 WBP killed in 2004. In 2004, that mortality was recorded on a combined 15,400 acres; that decreased to 12,200 acres in 2005. District-wide, on lands of all ownerships, WBBB infested almost 5,400 acres and FE 2,300 acres.

A general scattering of WBBB- and FE-killed trees were mapped on the Stillwater South Fork in the Whitefish Mountain Range. A few very large groups were recorded north of Whitefish Lake, but averaged only 1 tree per acre. A few MPB-killed LPP groups were also recorded. Ones near Meadow Lake, Beaver Lake, and Woods Lake were most noticeable.

On Forest Service-administered lands, in the North Fork Flathead River drainage (Glacier View RD), WBBB activity was very generally mapped throughout the District. Largest of those groups were noted in upper reaches of Coal Creek, Red Meadow Creek, and Whale Creek drainages. MPB-affected LPP and DFB-killed DF were very lightly scattered in host type throughout the District. More notable groups MPB-killed LPP were mapped along Dead Horse Ridge.

District-wide, MPB has infested more than 1,200 acres, DFB about 100, and WBBB nearly 5,000. Most are not major increases from 2004 levels.

Tally Lake RD. An increase in MPB and DFB activity was combined with decreases in FE- and WBBB- caused mortality on the District in 2005. Several larger groups of DFB-killed DF were noted in the Logan Creek drainage, and near Tally Lake. They were generally larger, but less intensely infested than in 2004. Most groups covered a few hundred acres or less and contained an average 1-2 trees per acre killed. WBBB remained active near Sheppard Mountain,

Elk Mountain, and above Bowen Creek, Robertson Creek, and Alder Creek drainages. MPB activity was observed in a lightly scattered pattern in a few LPP stands.

On District and adjacent lands, 4,600 acres (compared to 2,900 acres in 2004) showed some level of DFB-caused mortality; about 1,600 acres (900 acres in 2004) had MPB-killed LPP; only about 150 acres (6,200 acres last year) of FE-related activity; and less than 4,000 acres (7,700 acres in 2004) of WBBB-infested SAF.

Throughout the Flathead RA, and on lands of all ownerships, more than 62,500 acres have been infested by MPB (compared to 39,200 acres in 2004); 22,400 acres by FE (20,600 acres in 2004); 13,500 acres by DFB (5,700 acres last year); and 22,200 acres by WBBB (18,700 acres reported in 2004). Forest-wide, slightly less than 216,000 bark beetle-killed trees were recorded in 2005. Those were general increases over 2004 levels; however, more of the Forest was flown in 2005.

Gallatin Reporting Area

Big Timber RD. DFB activity was much reduced in Boulder River drainage in 2005. Significantly large groups were still found near Aspen Campground, Speculator Creek, Four Mile Station and Hicks Park Campground. Elsewhere, DFB-killed groups were very widely scattered in small clusters.

Minor amounts of SAF, affected by WBBB, and MPB-killed WBP were noted in some locations; with more significant amounts of WBP, killed by MPB, being found in the upper portion of Boulder River drainage—especially near Wareagle Mountain, Baboon Mountain, and north of Boulder Pass. A few small groups of MPB-killed LPP were located near Burns Flat, in West Fork Boulder River drainage.

In the Crazy Mountains, relatively minor amounts DFB-killed DF and SAF infested by WBBB were recorded in Big Timber Creek drainage. One large group of WBBB-killed trees was observed near Twin Lakes.

DFB-infested stands totaled about 2,450 acres—most in the Boulder River drainage. Almost 1,900 DF were killed. MPB has killed 4,900 WBP on 1,640 acres; and 4,200 SAF were affected by WBBB on nearly 1,600 acres. All of those figures were increases over 2004 levels. Minor amounts of LPP were impacted by MPB, District-wide.

Livingston RD. Widely scattered, small groups of DF, infested by DFB, were mapped both east and west of Paradise Valley. DFB activity was still concentrated in Mill Creek drainage, and while it has been much reduced from past years, infested acres increased in 2005. Groups there average generally less than about 80 trees each. Some few groups WBBB-killed SAF were also noted in upper Mill Creek.

A few small groups DFB-killed DF were mapped to the west—a notable concentration was located north of Eight Mile Creek. Widely scattered WBBB activity was noted in the Gallatin Range, as well.

In the Crazy Mountains, scattered small groups of WBBB-, DFB-, and MPB-killed trees were observed. MPB activity was confined to WBP stands. The largest groups of MPB-affected WBP were noticed near Davey Butte. WSBW population increases in the Crazy Mountains could lead to resurgence of DFB activity.

DFB infestations on the District covered less than 700 acres in 2004, and increased to almost 2,400 acres in 2005. Approximately 7,000 DF were killed. MPB activity in WBP stands accounted for 1,200 dead trees on 1,350 acres. Nearly 11,000 WBBB-killed SAF were noted on 4,600 acres. Both the latter were decreases from 2004. Little other beetle activity of note was found on the District.

Gardiner RD. Only the western portion of the District was flown in 2005. There,

widely scattered small groups DFB-killed DF, WBBB-affected SAF, and MPB-infested WBP were mapped. The largest groups DFB-killed trees were noted north and east of Jardine. WBP mortality was concentrated in several groups near Sheep Mountain, Ash Mountain and Mans Foot Mountain.

BR was reported as the most significantly damaging agent in WBP stands at several locations on the District; however, MPB and secondary bark beetles may also be affecting those trees.

Throughout the District, about 850 acres of DFB-infested stands were noted, up from 250 reported last year. Approximately 700 acres SAF were found to contain noticeable amounts of WBBB-caused mortality—down from 2,500 in 2004. On another 1,600 acres MPB killed close to 3,800 WBP—significantly less than the 7,000 killed on 4,300 acres in 2004. More than 1,800 acres were reported as affected by blister rust. Quite likely, many of those also contained MPB-caused mortality.

Bozeman RD. Many groups of WBBB-infested SAF stands were found scattered throughout the Gallatin Range, and to a lesser extent the Madison Range to the west. In both areas, infestation levels were much less extensive that recorded in 2004. Largest groups and highest concentrations of WBBB activity were in the Gallatin Mountains near The Sentinel, Eaglehead Mountain, Fortress Mountain and Twin Peaks. Other smaller groups more generally scattered.

DFB-caused mortality was also widely scattered in small groups, with notable concentrations in Bear Creek drainage south of Mount Ellis and east of Bear Trap Canyon in Bear Trap Creek drainage. Several large groups of MPB-affected WBP were mapped in upper Cherry Creek drainage, southwest of Bozeman.

In the Bridger Mountains, DFB activity was widely scattered in small groups; but extensive WSBW outbreaks and extreme levels of defoliation could lead to a resurgence of DFB populations. A few small groups of SAF, infested by WBBB were also noted in the Bridgers.

In total, whereas MPB infested nearly 11,000 acres of WBP stands (and blister rust another 2,600 acres) in 2004; only 4,100 acres MPB, and 1,100 acres blister rust were recorded this year. Acres of WBBB-affected SAF stands were also reduced slightly—from 14,200 acres last year, to 11,800 acres in 2005; but mortality increased from 19,000 to 24,000 trees. DFB activity was noted on almost 800 acres (3,100 dead trees); however, WSBW defoliation was reported on 76,700 acres in the Bridger Mountains. Many of those trees could attract DFB within the next few years.

Hebgen Lake RD. DFB-killed trees were still commonly found on both north and south sides of Hebgen Lake, but at much reduced levels from past few years. Bigger concentrations were in Trapper Creek and West Fork Trapper Creek drainages, south of the Lake. North of Hebgen Lake, larger groups were noted in Cabin Creek and Beaver Creek drainages.

Numerous large groups of WBBB-infested SAF were mapped in the southern portion of the Madison Range; but much less was recorded this year than in 2004. Largest groups located just north of Hebgen Lake, in the Sage Creek drainage, and from Cinnamon Mountain northwestward to Lone Mountain. Other large groups were seen near Lincoln Mountain.

Of great significance was continued expansion of MPB activity in WBP stands. Large groups mapped were observed north of Hebgen Lake, near Tepee Basin; above Sage Creek; and north and east of Lightning Lake. Largest groups on the District were found from Lightning Lake eastward to Sage Creek. Minor amounts of MPB-caused mortality were also found widely scattered throughout LPP type.

District-wide, in addition to an estimated 28,400 WBP killed on approximately 24,500 acres in 2004; another 24,100 trees were killed in 11,600 acres in 2005. Those estimates may be conservative. Data collected on ten variable-radius plots near Lightning Lake in 2004 showed, for the area surveyed, more than 160 trees per acre had been killed in the past 2-3 years. DFB activity has declined to just over 1,800 acres, on which 4,400 dead DF were recorded.

For the entire Gallatin RA about 9,520 acres of DFB-infested DF stands were observed, compared to 4,520 in 2004. Another 200 acres of MPB-infested LPP were mapped. That was virtually a static condition. Almost 21,000 acres of MPB-killed WBP—a decrease from 49,000 acres last year—was noted (almost 38,000 WBP were killed); and about 26,600 acres on which WBBB-killed SAF was found were mapped. Nearly 48,100 acres of WBBB-caused mortality had been recorded in 2004.

Helena Reporting Area

Townsend RD. DFB populations have begun to decline after several years of high populations following 2000 fires. Mostly small and very widely scattered groups of DFB-killed trees remained north of Townsend, in the vicinity of about Duck Creek north to Beaver Creek. A few larger groups were observed near Sunshine Basin, but overall, affected areas are much reduced. Extensive amounts of defoliation caused by WSBW on nearly 52,000 acres in that same general area could result in increasing DFB populations if weather conditions further weaken affected trees.

MPB populations in both LPP and WBP stands continued to expand significantly throughout their respective hosts. Groups of beetle-killed trees ranging in size from 50 to 4,000 trees each were mapped from Hedges Mountain southward to Mount Edith. Especially in WBP stands near Boulder Mountain, Mount Baldy and Mount Edith, MPB-caused mortality has been extreme. Ground-collected data in the vicinity of Mount Edith showed in some areas nearly 70% of the WBP over 5” d.b.h. (more than 200 trees per acre) has been killed in the last three years. BR was also prevalent in those stands.

A few large groups WBBB-killed SAF were noted along and near Shellrock Ridge. West of Townsend, beetle-killed groups are small and very widely scattered in DF and LPP types.

District-wide, DFB-infested trees were observed on almost 2,300 acres (down from 6,800 last year); MPB-killed LPP on 8,700 acres (up significantly from 1,800 acres in 2004), and beetle-impacted PP on fewer than 30 acres, much less than the 730 acres previously reported. MPB-caused mortality in WBP stands was reported as totaling 18,300 trees on 7,800 acres—not significantly different that the 16,000 trees on 6,760 acres recorded in 2004. Many of those trees were also infected by BR. WBBB-caused mortality was recorded on about 300 acres. Just over 800 had been reported in 2004.

Helena RD. MPB-caused mortality in PP was mapped in a very widely scattered pattern throughout stands north and south of Helena. Most groups were small, from 1 to 20 trees each. Highest concentrations were mapped south of Helena in the Little Buffalo Gulch and Whiteman Gulch areas. In those same areas, at higher elevations, MPB-killed LPP was also noted; however, most of those groups were small as well.

East of Helena, in the Tenmile Creek and Sweeney Creek drainages, MPB-infested LPP stands appeared to be increasing, although groups were still relatively small. DFB populations were still found affecting their hosts in small and widely scattered groups throughout DF type. That is another area, however, where extreme amounts of WSBW-caused defoliation could result in increasing DFB populations over the next few years.

Total DFB-infested area was about 1,200 acres—down from 2,200 acres last year. WSBW outbreaks on 16,100 acres could lead to DFB increased activity. MPB-killed trees were observed on 1,500 acres in LPP stands and another 930 acres in PP stands. WBBB killed SAF on another 550 acres, also reduced from 1,240 acres in 2004.

Lincoln RD. A very general scattering of small groups of DFB-killed DF, MPB-killed LPP and WBBB-killed SAF were mapped in the Nevada-Ogden area southwest of Lincoln. No significantly large groups were recorded—totaled but 1,300 acres, District-wide; however, large areas of DF defoliated by WSBW (totaling 19,000 acres) could lead to increases in DFB populations. Budworm populations were particularly high along the Continental Divide.

North of Lincoln, MPB populations appeared to be building in LPP stands in the Beaver Creek and Park Creek drainages and near Keep Cool Lakes—total for the District, about 1,900 acres. DFB-killed trees and a few groups of WBBB-killed SAF were mapped in the Arastra Creek drainage. Moderate-sized groups (up to 50 trees each) were noted near Stonewall Mountain and east of there, near Red Mountain, just north of Lewis and Clark Pass. WBBB totals for the District were 2,500 trees killed on 1,100 acres.

Throughout the Helena Reporting Area, and especially northwest of Helena, WSBW populations are increasing significantly. Defoliation, coupled with prolonged drought, could result in increased amounts of DFB activity within the next few years. Area-wide survey estimates for bark beetle-caused mortality for areas flown totaled: DFB 5,600 acres—compared to 10,800 acres last year; MPB 24,800 acres (19,400 acres in 2004), of which 13,300 acres were LPP, 2,000 PP, and 8,600 WBP (almost 45,000 trees, of all species were killed); and WBBB about 3,400 acres—almost no change from 3,200 acres last year.

Kootenai Reporting Area

Rexford RD. DFB populations have returned to near-endemic levels throughout the District. Very small and very widely scattered groups were found at a few locations in DF or mixed-conifer stands. A few larger groups remained in the Pinkham Creek drainage and especially near Virginia Hill, but most are 20- to 30-tree groups, or smaller. WBBB-infested SAF were also found in mostly small groups. A few larger ones were located near McGuire and Ellsworth Mountains to the east and Boulder Mountain to the west. Some small groups FE-killed GF were mapped at a few somewhat isolated locations. A small number of fairly large groups of MPB-killed WBP were observed near Robinson Mountain.

Fortine RD. DFB activity declined on the District once again in 2005. Beetle-killed groups were few, small, and widely scattered. Some of the larger groups were mapped in Sunday Creek drainage and its tributaries, south of Fortine. North of Fortine, in the Galton Range, DFB populations also declined markedly. Several large groups of WBBB-impacted SAF were mapped near Stahl Peak and Krag Peak. MPB-caused mortality in WBP increased near Kasanka Peak, north of Stahl Peak, and surrounding Mount Wam. Another group was located to the south near Mount Petery.

Totals for the District showed about 1,500 acres of DFB-killed DF (approximately 2 trees per acre); 700 acres of MPB-impacted LPP and another 900 WBP (average one tree per acre, each); and 2,200 SAF were killed by WBBB on 1,800 acres.

Three Rivers RD. DFB activity declined throughout the District in 2005. Beetle-caused mortality was still noticeable in small and scattered groups in DF type; but at a much reduced level from recent years. FE-killed GF was frequently encountered, although not in extreme amounts. A few of those larger groups were noted near and east of Yaak Mountain.

Most prevalent bark beetle activity on the District was attributed to WBBB. Larger beetle-killed groups of SAF were mapped near Marmot Mountain, Rock Candy Mountain, and Pink Mountain.

MPB-caused mortality in both WWP and WBP was also noted in significant-sized groups throughout the Yaak River drainage. Notable groups in WWP were mapped near Grizzly Point and Garver Mountain. WBP damage was more prevalent near Cross Mountain and Tepee Mountain. BR infections, common in the WWP type, were also associated with MPB activity. South of Troy, only very light and widely scattered bark beetle activity was observed.

District wide, about 900 DF were killed by DFB on 300 acres—down from 4,400 trees on 1,300 acres in 2004; WBBB killed 4,600 SAF on 5,700 acres—up markedly from 2,400 acres and 1,900 trees last year; and 1,200 FE-killed GF on were noted on 700 acres—both slight increases. MPB-killed trees were recorded on 1,200 acres of LPP stands; 1,700 acres of WBP; and another 1,000 acres of WWP. More than 9,100 WBP; 2,800 LPP; and 350 WWP were killed.

Libby RD. Bark beetle activity of all species, in their respective hosts, was greatly reduced throughout the District in 2005. Nearly endemic amounts of DFB activity were recorded both north and south of Libby—totaling but 1,200 acres. FE activity is more common, but reduced from 2004 levels—4,600 acres compared to 7,800 acres. Notable concentrations were mapped south of Libby in the Cameron Creek drainage, and to the north in Quartz Creek and Bobtail Creek drainages. Minor amounts of MPB-killed trees were noted at a few isolated locations in WPB, WWP, and LPP stands.

Beetle-infested stands on the District totaled: DFB, 1,200 acres—3,000 dead DF; FE, 4,600 acres—7,300 beetle-killed GF; MPB (all hosts, but mostly LPP), fewer than 300 acres; and minor amounts of WBBB- and WPB-caused mortality.

Cabinet RD. As DFB populations, and associated damage returned to near-normal levels; MPB-killed LPP was increasing in parts of the District. Small amounts of DFB-killed trees were noted in Stevens Creek and Pilgrim Creek drainages and to the north in Rock Creek drainage and near Government Mountain. Significant, however, were large groups of MPB-infested LPP mapped in Little Beaver Creek and White Pine Creek drainages south of the Clark Fork River, and throughout the Vermilion River and its tributaries to the north. These infested areas increased markedly just within the last year or so.

FE activity was still noted in a few GF or mixed-species stands, with a few of the larger groups mapped in the upper Trout Creek drainage. WSBW activity on the District, not recorded in the past quarter century, was heavy in some stands and could lead to an increase in DFB activity within the next few years.

District-wide, DFB-killed DF was found on 220 acres; MPB infested 30,300 LPP on 9,400 acres and another 400 WWP on 620 acres; FE killed 1,300 GF on 2,000 acres; and WBBB activity was minor.

Total mortality attributed to bark beetles in the Kootenai RA in 2004 was: 12,000 DF killed by DFB on 5,400 acres (21,000 trees on 9,100 acres in 2004); 11,000 GF killed by FE on 7,700 acres (8,500 trees and 9,100 acres in 2004); 34,200 LPP killed by MPB on 11,500 acres (10,400 trees on 1,500 acres last year); 16,500 WBP and 1,700 WWP killed by MPB on a combined 17,200 acres; and 13,000 SAF killed by WBBB on 12,400 acres (5,700 acres in 2004). Minor amounts of mortality attributed to IPS were also recorded in 2005.

Lewis & Clark Reporting Area

Rocky Mountain RD. The District was not flown in 2005 nor has it been for the past

several years. We have no current record of bark beetle activity on the District.

Judith RD. A very general scattering of mostly small groups of beetle-killed trees were noted throughout the District during the past year. Most activity was recorded as MPB-killed PP, found in small groups north and east of the Little Belt Mountains. Many of those groups were concentrated throughout the South and Middle Forks of the Judith River. Other noticeable groups were observed in the Running Wolf, North Fork Running Wolf, and Dry Creek drainages.

Significant groups of MPB-infested WBP were found in the central portion of the District—especially near Yogo Peak, Tepee Butte, and Kelly Mountain. WBBB activity was recorded near Big Bald Mountain, Yogo Peak, Tepee Butte, and Big Bear Point. In the Highwood Mountains, very light and widely scattered groups of DFB-killed DF and MPB-impacted LPP were noted. A small amount of MPB-infested PP was recorded in the Big Snowy Mountains.

On BLM-administered land north of Lewistown, in the Judith and North and South Mocassin Mountains, very widely scattered MPB-caused mortality was noted in a few PP stands. Most were small groups; a few were as large as 150 trees, but most were less than 100.

District-wide, DFB was found on 240 acres (350 acres last year); MPB on almost 3,900 acres—on all hosts, but most was PP (nearly static conditions); WBBB on nearly 1,250—2,000 acres in 2004; and BR on another 2,300 acres (4,750 acres last year). Most of that latter was probably also infested by MPB.

Musselshell RD. Widely scattered small groups of trees killed by several bark beetle species were recorded in the Little Belt and Castle Mountains. Numerous, though mostly small, groups DFB-killed DF were recorded from Green Mountain eastward to Bluff Mountain.

MPB-caused mortality in PP and LP stands was common from Bartleson Peak east to Farmer Spring. MPB-killed WBP was prevalent in higher-elevation stands to the west—especially big groups were mapped near Hoover Mountain, Smoky Mountain, and along Lost Fork Ridge. MPB-infested LPP stands were also common in some larger groups, north of Lake Sutherlin and in the Castle Mountains. Significant WSBW activity throughout the area could lead to increases in DFB populations.

In the Crazy Mountains, widely scattered small groups of WBBB-infested SAF and MPB-impacted WBP were observed. Small amounts of DFB-killed DF were also noted. MPB activity in WBP stands was concentrated near Box Canyon and south of Mount Elmo. Numerous small groups of WBBB-killed trees were found near Loco Mountain. Small amounts of MPB-killed trees were noted in LPP type.

Throughout the District, about 1,600 PP were killed by MPB on roughly 1,400 acres. Both figures were reduced from 2004 levels of 2,100 trees on 2,700 acres. DFB killed 2,050 trees on 770 acres—also reduced from 1,080 acres and 2,700 trees last year. MPB and blister rust affected WBP and LP on more than 2,600 acres (6,400 acres in 2004); and MPB alone on 1,000 acres of LPP—the same as last year. WBBB killed 2,200 trees on 1,200 acres—fewer than previously recorded.

Kings Hill RD. Widely dispersed and mostly small groups of DFB-infested DF, WBBB-affected SAF, and MPB-killed LPP were noted throughout the reporting area. Notably larger groups of MPB-killed WBP were located near Kings Hill and south of Mizpah Peak. Larger groups MPB-infested PP were also noted to the north, near Logging Creek and in the Sawmill Gulch and Logging Creek drainages.

MPB was also active in PP stands to the west, in Tenderfoot Creek drainage. MPB activity in LPP stands was mapped as small groups to the south, near Miller Gulch.

WSBW activity, common in southern Little Belts, could precipitate increased DFB populations.

Totals for the District were about 6,000 SAF killed on more than 2,100 acres (more trees, fewer acres than last year); 3,000 PP and 10,400 LPP killed by MPB on 1,600 acres and 3,300 acres, respectively (fewer totals for PP, more for LPP); MPB and blister rust have affected WBP on more than 3,900 acres, and DFB killed 2,400 trees on 1,400 acres. Those latter figures represent a decline in WBP mortality, and an increase in DFB activity.

Area-wide mortality attributed to bark beetles in the Lewis & Clark RA totaled almost 5,700 DF on 2,600 acres (virtually static conditions from 2004); and 41,100 MPB-killed trees on 20,300 acres—of all hosts, roughly one-third each of LPP, PP, and WBP. Very similar figures were reported in 2004. Another 12,200 SAF were killed on 4,500 acres (9,700 acres in 2004).

Lolo Reporting Area

Missoula RD. DFB-killed DF were still quite prevalent throughout Rock Creek drainage, but groups were much smaller and more widely scattered than in the past few years. Largest groups were recorded near Burnt and Golden Mountains in the north, near Spink Point and in the Butte Cabin Creek drainage in the central part of the Corridor, and in the Hogback Creek drainage to the south. Although fader groups were numerous, ground surveys suggested fewer currently infested trees in most areas in 2005 than in previous 2-3 years. Throughout the District, on lands of all ownerships, 20,600 DF were killed on 6,700 acres. About 4,700 acres had been recorded in 2004.

In the northern end of the Sapphire Mountains, from Mitten Mountain to Elk Mountain, southeast of Missoula, MPB-killed LPP has increased significantly. Numerous groups were mapped in that area, many covering several hundred acres and containing 3-5 beetle-killed trees in each.

North of Missoula, in the Rattlesnake Creek drainage, MPB-infested LPP was also quite prevalent. Largest groups were observed near Blue Point, Stuart Peak, Shoofly Meadows, and southwest of Bull Lake. To the west of Missoula, in the Grave Creek Range, MPB activity in LPP stands also increased—from Blue Mountain to Telephone Butte. A few groups of faders extended to several hundred acres each.

District totals in 2004 included 11,200 acres of MPB-killed trees (mostly LPP). Those infested acres increased in 2005 to 15,800; on which more than 66,000 trees were killed. Lesser amounts of MPB in PP and WBP and WBBB in SAF were reported in 2005.

Ninemile RD. MPB activity in LPP stands was the most dominant insect infestation on the District in 2005. While having declined somewhat from 2004 levels, due to host depletion, thousands of acres were still infested—the most extensive outbreaks being along the divide between Flathead IR and the District. Very large polygons were mapped from upper Sixmile Creek, northwest to Three Lakes Peak. South of Ninemile Creek, and along Ninemile Divide, additional large groups of beetle-killed trees were mapped—from Stark Creek to Mattie Creek. The outbreak has finally run its course near Siegel Pass, where few infested trees were noted. Ground-collected data, for a 10-plot area near Siegel Pass showed an average 187 trees per acre had been killed by MPB over the past several years.

Elsewhere throughout the Ninemile Creek drainage, minor amounts of DFB-infested DF, and both MPB and WPB-caused mortality in PP stands was observed. No significant outbreaks of those were noted, however.

South of the Clark Fork River, in Albert Creek, Petty Creek, Fish Creek, Rock

Creek, and Trout Creek drainages, significant groups of MPB-killed LPP was recorded. Largest groups were mapped in Fish Creek, Rock Creek, and Trout Creek drainages near White Man Lookout, McMullan Peak, Patrick Peak, Sunrise Mountain and Prospect Mountain. Minor amounts of WBBB, DFB, and MPB (in PP stands) activity was reported south of the Clark Fork River.

In 2005, throughout the District, more than 438,000 LPP were killed by MPB on nearly 50,000 acres. MPB killed another 2,600 PP on 2,500 acres; 1,300 DF were killed by DFB on 420 acres; and WBBB killed 150 trees on 220 acres. A minor amount of WPB activity was also noted.

Plains/Thompson Falls RD. Much of this District was not flown in 2004, so direct comparisons with last year cannot be made. MPB-caused mortality in LPP, while still very extensive, declined in many stands due to host depletion. Largest groups remained in Coeur d'Alene Mountains west of Plains and South of Thompson Falls. Most extensively infested areas in that portion of the District were still from Knox Pass, west to Taft Summit, along the divide with Superior RD to the south. To the east, towards Sunset Peak and Combest Peak, infested groups were much smaller. Ground-collected data for a 10-plot area near Mount Bushnell showed an average 120 trees per acre killed by MPB during the past 5 years.

North of the Clark Fork River, outbreaks increased throughout the Thompson River drainage. Large groups of faders were mapped on the east from Big Rock Creek south to Baldy Lake, and contained especially high amounts of mortality in McGinnis Creek and along Corona Divide. Data collected from variable-radius plots near Mount Baldy and Corona Divide, showed an average 150 and 53 LPP, killed by MPB, respectively over the last few years.

To the west, large groups were mapped in the Fish Trap Creek drainage, particularly near Two Trees Point, Lone Tree Peak, Marmot Peak and Duckhead Lake. Northwest of there, several large groups were observed in Winniemuck Creek drainage, and near Cougar Peak. A few groups MPB-killed WBP were also recorded near Marmot Peak. Minor amounts of WBBB- and DFB-killed trees were recorded in appropriate host types. Small amounts of MPB activity in LPP, PP, and WPB stands was reported east of Paradise.

Totals for the District and adjacent State and private lands in 2005 showed 408,000 MPB-killed trees on more than 64,800 acres—most of which were in LPP stands; about 750 acres infested by DFB; 910 acres with WBBB-caused mortality; and about 50 acres infested by WPB. We obtained almost no data for 2004, but those MPB-infested figures are considerably higher than recorded in 2003. DFB, WBBB, and WPB were nearly static.

Seeley Lake RD. MPB-caused mortality was prevalent in a few small groups of LPP south and west of Seeley Lake, particularly in Placid Creek and Finley Creek drainages. To the east and north of Seeley Lake, in the vicinity of Richmond Peak and near Florence Lake, larger groups of LPP had been killed by MPB. WBP heavily impacted by MPB, was noted in several large groups near Morrell Mountain, near East Spread Mountain, and close to Conger Point. To the west, other groups were seen near Mount Henry and West Fork Point. MPB infestations in LPP intensified in 2005. MPB-affected stands totaled about 9,850 (2,000 acres in 2004) of LPP, where MPB was the sole mortality agent, and another 12,600 acres (8,900 acres last year) of WBP with mortality attributed to both MPB and BR.

Elsewhere on the District, DFB-killed trees were more widely scattered and in smaller groups in 2005. Throughout the DF type, DFB-caused mortality increased only slightly, to 1,100 acres. About 1,060 acres

were reported in 2004. WBBB-caused mortality was observed on nearly 620 acres (400 acres last year) in a few high-elevation SAF stands. Minor amounts of MPB-killed PP were also noted on the District.

Superior RD. Large groups of MPB-killed LPP were mapped from near Chimney Rock, southwestward to Prospect Creek. Elsewhere, south of the Clark Fork and St. Regis Rivers, very large groups of MPB-killed LPP—some totaling hundreds of thousands of trees—were mapped from Cedar Creek on the east to Lookout Pass on the west. North of the St. Regis River, throughout the Coeur d'Alene Mountains, largest beetle-infested groups were recorded near Brooks Mountain, Knox Pass, and Mount Bushnell—on the divide between Superior and Plains/Thompson Falls RDs. District-wide more than 47,200 acres were infested in 2003. We believe most of those outbreaks continued to expand in 2004, but in some of the areas that have been infested for several years, there likely was a decrease in intensity. Ground-collected data for a few sites on the District showed extreme amounts of MPB-caused mortality in LPP stands during the past few years: East Fork Dry Creek, 138 trees per acre; CC Divide, 103 trees per acre; Dry Creek (permanent plots), 143 trees per acre. MPB-caused mortality in LPP stands on the District totaled 453,300 trees on 64,000 acres.

Significant amounts of MPB-caused mortality were recorded in PP stands east of Superior, from Round Mountain northwest to Sloway Gulch. Largest groups were noted in First and Second Creek drainages. Acres with noticeable amounts of PP mortality declined somewhat, but still totaled about 400 acres. At least some of that mortality is thought to be drought related. Ground surveys showed still-increasing populations in many areas. In some, host depletion has resulted in population declines; however, in a few areas surveyed, 2004 attacks averaged more than 120 per acre. MPB affected PP on just over 1,000 acres where 2,300 trees were killed.

Relatively minor amounts of other bark beetle-killed trees were reported.

Throughout the Lolo RA—the most heavily impacted in the State—MPB killed LPP more than 1.4 million LPP on 204,400 acres; 9,600 PP killed on 5,400 acres; and nearly 10,800 WBP on 7,800 acres (however, most of those acres were also reported as affected by blister rust). Although much less significant, DFB reportedly killed about 31,000 DF on 10,400 acres; WPB killed 120 PP on 135 acres; WBBB accounted for 3,700 dead SAF on 2,600 acres, and FE killed 2,600 GF on nearly 2,700 acres. A very minor amount of IPS activity was also reported.

Garnet Reporting Area (BLM)

Greatly increased amounts of MPB-killed LPP were recorded throughout the reporting area. Larger groups were mapped from the western side, near Bonner Mountain, eastward towards Mammoth Mine and Lost Horse Mountain; then to the eastern portion, near Gravely Mountain. Most LPP stands appeared to be infested to a greater or lesser degree. To a much lesser extent, and in much smaller groups, MPB-killed PP was also mapped in a widely scattered pattern. DFB-infested DF was also found in many mixed-species stands, but large groups were uncommon. Some of the largest of those were noted near Union Peak. Increasing WSBW populations could exacerbate that situation. WBBB-affected SAF stands were widely found in small groups in high-elevation sites. The more noticeable of those were recorded near Elevation Mountain.

In total, about 7,800 DF were killed on 3,200 acres—slight increases over 7,200 trees and 2,600 acres recorded in 2004; MPB killed approximately 18,500 LPP and 930 PP on a combined 12,600 acres (9,800 LPP and 570 PP on 5,500 acres last year); and 920 dead SAF on 440 acres (up slightly from 280 acres last year) were attributed to WBBB. Most significant increases in the area were in MPB-killed LPP.

INDIAN RESERVATIONS

Blackfeet IR

The Reservation was not flown in 2005, however in 2004, the western portion was surveyed along with Glacier NP. Last year, a few small groups of DFB-killed DF and MPB/IPS-killed LPP were mapped near Lower Saint Mary Lake. The most significant bark beetle-caused damage, however, was several large groups of SAF, killed by WBBB, recorded near Cut Bank Ridge and in upper tributaries of North Fork Cut Bank Creek. On the part of the Reservation flown in 2004, an estimated 4,000 SAF were killed on about 2,600 acres.

Crow IR

Very small and widely scattered groups IPS-killed PP were observed throughout the Wolf Mountains, east of Lodge Grass. The largest group, of about 400 trees, was mapped north of Shortys Hill in the Corral Creek drainage.

In the Pryor Mountains, to the west, numerous groups of WBBB-killed SAF were mapped in higher-elevation tributaries of Pryor Creek. Minor amounts of MPB-killed LPP, LP and PP were found at a few locations. IPS-killed PP and DFB-killed DF were recorded at nearly endemic levels.

Throughout the Reservation, 227 PP were killed by MPB on 140 acres; 110 LP were killed by MPB on 100 acres; 150 MPB-killed LPP were noted on 100 acres; DFB killed 110 DF on 40 acres; and 640 SAF were killed by WBBB on 330 acres. Those totals were not significantly different from 2004.

Flathead IR

MPB-caused mortality increased remarkably throughout LPP stands on the Reservation. In the Mission Range, east of Flathead Lake, the infested area increased significantly. Large groups of beetle-killed trees were mapped from Yellow Bay Creek on the north, south to the Reservation boundary at the Rattlesnake Wilderness. Very large groups, some exceeding 3-4,000 acres each were recorded throughout the Jocko River drainage and its tributaries in the southeastern portion of the Reservation. Some larger groups averaged 5 trees per acre killed in 2004 (recorded as faders during surveys in 2005).

Outbreaks remained high, although somewhat reduced from past years to the south, along Reservation Divide. Very large groups were still found near Saddle Mountain, in the Valley Creek drainage, and west of Warden Mountain.

To the west, large MPB-killed groups of LPP were recorded in the vicinity of Rainbow Lake, Hot Springs and northward towards Mill Creek and Bassoo Peak.

Elsewhere, MPB-killed PP was found quite generally throughout PP type, though in much smaller groups. Highest concentrations found to the south in the Hewolf Creek drainage, northward to Sonyok Mountain, Coppedge Gulch and north through the Salish Mountains to just south of Lake Mary Ronan. Some MPB-infested PP and FE-killed GF were found lightly scattered in foothills of the Mission Mountains, east of Flathead Lake. Some IPS and WPB activity was also recorded in a few PP stands; however, there may have been more that was recorded, either in conjunction with MPB, or recorded as MPB. Minor amounts of WBBB-killed SAF were mapped in a few high-elevation stands to the southeast.

Because not all of the Reservation was flown in 2004, comparison figures for beetle-infested areas could not be made in 2005. This year, total beetle-infested areas on the Reservation included 410 DF killed on 200 acres; 11,400 PP and 230 WBP killed by MPB on 15,100 1,300 acres, respectively; 6,200 SAF killed on 6,000 acres by WBBB; and FE killed almost 6,200 GF on 5,600 acres. The most significant damage recorded, however, was the 214,800 LPP killed by MPB on nearly

90,600 acres. That was a considerable increase over the infested area recorded in 2004; but again, not all of the Reservation was flown in either 2003 or 2004.

Fort Belknap IR

The Reservation was not surveyed in 2005; however, conditions were likely little changed from those observed in 2004. Very widely scattered and generally small groups of MPB-killed PP and LPP were mapped across the Reservation last year. Groups ranged in size from 1-150 trees, with concentrations noted near Thornhill Butte, Eagle Child Mountain, and near Mission Peak. Most of the latter were small groups of LPP. The largest of those contained an estimated 25 trees. About 530 PP were killed on slightly fewer than 160 acres. Another 125 LPP were killed on about 40 acres. Both of those figures represented nearly static conditions.

Northern Cheyenne IR

Minor amounts of IPS-killed PP, recorded in very small groups, were mapped in a widely dispersed pattern throughout the Reservation. Largest groups were found east of Hollowood Creek, and north of Busby. Populations appeared to be not much higher than endemic levels. Some beetle-caused mortality may have been caused by MPB.

Reservation-wide, about 4,400 PP on 2,200 acres were recorded as having been killed by IPS. Another 110 PP on 175 acres were killed by MPB. Those are figures represented decreases in MPB-infested areas, but increases in IPS-infested ones. It is conceivable that there is more interaction between MPB and IPS in PP stands on the Reservation than can be detected from the air.

Rocky Boys IR

A few moderately-sized groups of MPB-killed trees, in both LPP and PP stands, were found south of Tribal headquarters, in stands on Black Mountain, Centennial Mountain, and Sawmill Butte. Largest groups were recorded in LPP stands on Black Mountain—especially in the vicinity of Black Canyon. PP groups were generally much smaller. A few small groups DFB-infested DF were mapped near Lost Canyon. Generally fewer beetle infested groups were noted in 2005 in areas being aggressively managed to reduce the number of beetle-infested trees and threatened stands.

Slightly more than 3,100 beetle-killed LPP were mapped on about 930 acres—a marked increase from the 200 acres reported in 2004. Another 320 PP were killed on 330 acres, but there may have been more beetle activity in PP stands than reflected in this year's estimates. DFB killed about 400 trees on 160 acres—a slight increase over data recorded last year.

NATIONAL PARKS

Glacier NP

Glacier NP was not flown in 2005. The report for 2004, probably not changed significantly, is reproduced here.

Within the past 2-3 years, wildfires have affected thousands of acres of forested stands, in the western, central, and southern portions of the Park. Associated with some of those were increasing amounts of DFB-caused mortality—observed in many widely scattered locations, but near many burned stands, particularly near Kintla, Bowman, Quartz, and Logging Lakes. In response to drought-induced damage, FE populations have built in GF stands at several locations in the Park. The largest of those was located in the Pinchot Creek drainage. And MPB-killed LPP was noted in small and very scattered groups throughout LPP type.

Most significant amounts of beetle-caused mortality in the Park were large groups of SAF killed by WBBB. Largest of those was mapped near Logging Mountain; however, several other large groups were observed in high-elevation stands.

Park totals for 2004, included 5,100 DF killed by DFB on 3,300 acres; 4,800 GF killed by FE on 4,050 acres; 720 of various MPB hosts were killed on 850 acres; and WBBB killed 18,300 SAF on just over 8,200 acres. All outbreaks increased over previously recorded figures.

Yellowstone NP

Yellowstone NP, not surveyed in 2004, was once again flown in 2005. Remnants of a large ESB outbreak, southeast of Yellowstone Lake, recorded at more than 8,000 acres in 2003 has been reduced to but a few thousand acres.

Minor amounts of MPB-killed LPP, DFB-infested DF, and WBBB-affected SAF stands were mapped in a widely scattered pattern at various locations throughout the Park. In contrast, significant outbreaks of MPB in WBP stands were mapped in the southeast portion of the Park, from Lynx Creek north to Avalanche Peak. Largest groups were noted around Colter Peak, Mount Langford, and Sylvan Pass. Other large groups were recorded near Frederick Peak and Mount Washburn. In the northwest part of the Park, other significant groups of MPB-killed WBP, interspersed with WBBB-killed SAF, were noted near Dome Mountain, Bannock Peak, Little Quadrant Mountain, and Meldrum Mountain. Minor amounts of DFB could be exacerbated by increasing populations of WSBW in the vicinity of Mammoth.

In 2004, ground observations detected a very large MPB outbreak in WBP stands in the vicinity of Avalanche Peak. Ground-collected data in that area showed an average 95 WBP per acre killed within the past 2-3 years.

Beetle-killed totals for the Park, in 2005, included 860 DF, attributed to DFB on 350 acres; 2,100 ES on 1,800 acres killed by ESB; 1,650 LPP on 1,300 acres killed by MPB; 365,200 WBP killed by MPB on 29,200 acres; and finally, 24,300 SAF were killed by WBBB on 11,690 acres. The biggest increases since 2003, by far, were noted.

DEFOLIATORS

Western Spruce Budworm

In Montana, number of acres defoliated by western spruce budworm increased more than two-fold between 2004 and 2005. In 2005, a total of 453,739 acres were mapped as defoliated by budworm. In 2004, acres that were flown and mapped with defoliation was about 187,000, of which 177,000 was from western spruce budworm. Due to the unpredictable and inclement weather conditions during the survey period in 2004, acreage figures for defoliation were an underestimate.

Very few acres (160 acres total) were defoliated on the Lolo and Bitterroot-two reporting areas west of the divide that have historically had significant defoliation during previous outbreaks. During the outbreak in the 1980s, 2.6 million acres in the region were defoliated by budworm; with almost 200,000 acres defoliated each on the Bitterroot and Lolo reporting areas. Wildfires in the budworm host type have occurred in several areas on these forests that were historically defoliated by budworm. This may be the reason in part for the decline in defoliation on the Lolo and Bitterroot reporting areas. On the Kootenai reporting area, 19,395 acres were defoliated by western spruce budworm in 2005. An additional 228 acres of primarily mature western hemlock were defoliated on the Cabinet RD on the Kootenai NF. During late last summer, we were not able to identify the insect responsible for the defoliation. Historically, defoliation episodes from budworm on the Kootenai have been short-lived and are not very expansive in acres.

Number of acres defoliated by budworm in 2005 not only increased in extent, but, also

in intensity. In 2005, we recorded very heavy defoliation on Douglas-fir on the Helena and Gallatin reporting areas. We are monitoring potential tree mortality from budworm in these areas via ground surveys. We also recorded areas of defoliation from budworm that had never been recorded via aerial survey. Also in 2005, we recorded localized defoliation from an "unidentified defoliator" near Spar Lake on the Kootenai NF. We suspect that this defoliation was caused by either western spruce budworm or hemlock looper.

We did not fly Yellowstone National Park in 2004 but land managers estimated about 3,000 acres of fir-type were defoliated by budworm. In 2005, we recorded 1,970 acres of defoliation caused by western spruce budworm in Yellowstone National Park.

Acres of aerially visible western spruce budworm defoliation on all ownerships in Montana in 2004 and 2005

	Acres		
Reporting Area	**2004**	**2005**	**Difference**
Beaverhead	36,801*	60,818	+24,017
Blackfeet IR	410	Not flown	
Crow IR	82	0	-82
Custer	47*	0*	-47
Deerlodge	29,432*	52,561	+23,129
Flathead IR	824*	0	-824
Gallatin	73,009	124,487	+51,478
Garnet	101	16,785	+16,684
Glacier NP	2,325	Not flown	
Helena	31,173*	145,039	+113,866
Kootenai	2,049	19,398	+17,349
Lewis and Clark	1,131*	28,214	+27,083
Lolo	0*	160	+160
Yellowstone NP	Not flown	1,970	

*= Partially surveyed

Douglas-fir Tussock Moth

Pheromone-baited sticky traps have been used in western Montana since 1979 to monitor populations of Douglas-fir tussock moths. In 2005, traps were placed at 28 permanent plots and recovered from 27 plots.

The highest average numbers of male moths were caught from plots located in Jette Lake (9.2), Big Arm (3.8), and Rocky Point (3.4). Defoliation was apparent along the western shore of Flathead Lake between Jette Lake and Somers. Populations at Jette Lake, Big Arm, Rocky Point, Pistol Creek, and Kerr Dam have significantly decreased from previous years and no plots had an average increase of more than one moth caught per trap.

In addition to a tussock moth egg mass survey conducted in 2004, a subsequent egg-mass survey was conducted near Jette Lake, north of Polson, in May of 2005. Both surveys indicated a decline in tussock moth populations which was supported by low trap catches of adult moths in 2005. In general, the population through out the Region appears to be continuously declining.

Table 1. Douglas-fir tussock moth trap catches western Montana 1996-2005

Average number of male moths per trap

Plot	Location	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Albert Creek	14N, 21W, S16	0.0	0.0	0.0	0.4	1.2	3.2	2.6	0.0	0.0	0.0
Arlee	16N, 20W, S1	0.0	0.0	0.0	1.6	0.8	4.6	7.0	0.0	*	0.0
Big Arm	24N, 21W, S36	0.2	0.0	0.0	0.0	0.8	13.0	30.0	5.0	29.6	3.8
Big Fork	27N, 19W, S36	0.0	0.0	0.0	0.0	2.2	0.4	0.0	0.0	0.0	0.3
Blue Mountain	13N, 20W, S34	0.0	0.0	0.6	1.2	0.4	10.8	18.0	0.0	0.0	0.0
Butler Creek	16N, 23W, S24	0.2	0.0	0.0	0.4	2.8	8.4	9.6	0.0	0.2	*
Clear Creek	19N, 24W, S26	0.0	0.0	0.0	0.4	*	0.6	1.2	0.0	2.0	0.0
Corral Creek	15N, 22W, S36	0.0	0.4	0.0	0.6	0.8	1.0	2.4	0.0	0.8	1.0
Ferndale	27N, 19W, S32	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.6	1.0
Fish Creek	14N, 24W, S6	0.0	0.0	0.0	0.0	1.0	0.4	0.0	0.0	*	0.0
Foys Lake	28N, 22W, S36	0.0	0.0	0.0	0.0	0.0	3.4	0.6	0.2	1.0	0.2
Frenchtown F	14N, 21W, S10	0.0	0.0	0.0	0.4	0.4	0.8	0.4	0.0	0.4	*
Frenchtown J	14N, 21W, S22	0.0	0.0	0.0	0.2	1.6	2.4	6.8	0.2	0.0	*
Frenchtown T	14N, 21W, S23	0.0	0.0	0.4	0.0	1.4	4.8	12.8	0.0	0.4	0.0
Jette Lake	23N, 21W, S2	0.8	0.0	0.4	2.0	6.0	50.0	72.6	15.6	34.8	9.2
Kerr Dam	22N, 21W, S13	0.0	0.0	0.2	0.4	8.6	22.8	27.4	0.0	8.2	0.8
Lake Mary Ronan	25N, 22W, S23	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	1.0	0.0
Lakeside	26N, 20W, S6	0.0	0.0	0.2	0.0	2.2	0.6	0.0	0.0	*	0.2
Lolo Creek	11N, 20W, S6	0.0	0.2	0.0	0.0	1.0	2.6	0.2	0.0	0.0	0.0
Pattee Canyon	12N, 19W, S12	0.0	0.0	0.2	0.0	1.2	8.6	20.6	6.6	0.2	0.0
Petty Creek	14N, 22W, S19	0.0	0.2	0.0	0.8	9.8	7.6	4.6	0.0	*	0.0
Pistol Creek	18N, 20W, S35	0.4	0.4	1.2	63.6	13.8	55.8	62.2	11.4	38.0	0.8
Polson-Big Creek	22N, 19W, S21	0.0	0.0	0.0	0.6	0.2	3.4	5.2	0.2	1.4	1.3
Polson-Hell Roaring	22N, 19W, S33	0.0	0.0	0.0	0.0	2.0	0.8	0.4	0.0	2.0	0.2
Polson-Lost Lake	22N, 19W, S17	0.0	0.0	0.2	0.2	3.4	4.6	3.4	0.0	0.4	0.2
Revais Creek	17N, 22W, S4	0.0	0.0	0.0	0.8	1.6	1.6	2.2	0.0	1.0	0.2
Rocky Point	23N, 20W, S4	0.0	0.2	0.0	0.6	1.4	21.6	30.0	0.6	15.2	3.4
St. Mary Lake	18N, 19W, S35	0.0	0.2	0.0	0.0	1.0	4.4	0.8	0.0	0.2	2.0
Skidoo Bay	23N, 19W, S2	0.0	0.0	0.0	0.0	0.2	0.6	6.0	0.2	0.2	0.3
Smith Camp	25N, 20W, S8	0.0	0.0	0.0	0.0	0.4	0.4	0.2	0.4	3.2	*
Somers # 1	27N, 21W, S27	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.2	1.2	0.0
Somers # 2	27N, 20W, S26	0.0	0.0	0.0	0.0	1.4	1.6	1.0	0.0	0.8	0.3
Worden Creek	12N, 20W, S21	0.0	0.0	0.0	0.0	0.2	0.0	1.2	0.0	0.0	*

Gypsy Moth

Cooperative detection monitoring for the European gypsy moth in Montana in conjunction with Animal and Plant Health Inspection Services (APHIS) and Montana Department of Agriculture has continued. No moths were caught in detection traps. Monitoring will continue in 2006.

Other Defoliators

Defoliation from an unidentified insect was recorded on 228 acres near Spar Lake on the Kootenai; 37 acres of similar damage was also recorded on the Kaniksu. We only found the damage and not the insect itself during our ground surveys of the areas in 2005.

Larch Sawfly defoliated 133 acres of larch on the Beaverhead. Although defoliation from sawflies can be dramatic, outbreaks are localized in area and are usually short-lived. The larvae feed in colonies on needles from late June through August. Two acres of defoliation from larch bud moth were recorded on the Deerlodge. Larvae feed in needle clusters that are lined with silk, or in webbed branches between May and July.

DETECTION SAMPLES

The FHP office receives samples from across Montana each year for identification of forest insects and diseases. The number of samples received over the last 15 years has declined from about 50 samples per year to about a dozen or less. Samples received during 2005 are shown in the following table.

Report Number*	Date Received	Host	Pest ID	Tree Part
05-3	02/15/05	Douglas-fir	Probable herbicide	Foliage and shoots
05-4	05/16/05	Birch	Aphid (*Betulaphis* sp.?)	Foliage
05-5	06/30/05	Fir	Probable chemical	Foliage and branches
05-6	07/18/05	Wood in use	Carpenter and thatch ants	Cabin logs
05-7	07/22/05	Douglas-fir	Cooley spruce gall adelgid	Foliage and shoots
05-8	08/18/05	None	Ten-lined June beetle	None
05-9	08/23/05	Aspen	Marssonina leaf spot	Foliage
05-10	08/29/05	Willow	Probable *Pontania proxima*	Foliage galls
05-11	09/22/05	None	Western pine sawyer	None

*Report numbers 05-1 and 05-2 are not shown since they were received in the 2004 calendar year

DISEASE HIGHLIGHTS

Needle Diseases

Aerial detection surveys reported 16,792 acres of conifer foliar diseases. Lodgepole pine needlecast, caused by *Lophodermella concolor*, was responsible for more than half the needle disease acres reported with 14 acres on the Deerlodge Reporting Area (RA), 5,501 acres on the Gallatin RA, 3,637 acres on the Helena RA, and 403 acres on the Lolo RA. Larch needle diseases accounted for 5,280 acres on the Kootenai RA and 1,617 acres on the Lolo RA. This is an increase over the less than 3,000 acres identified in 2004, but still far less than the more than 33,000 acres observed in 2003. Most of our site visits in 2005, showed the larch needlecast fungus (*Meria laricis*) as the cause of foliar symptoms, but the larch needleblight pathogen (*Hypodermella laricis*) and the larch casebearer (*Coleophora laricella*) may also contribute to acres reported on larch. Three hundred and forty acres of Elytroderma needle disease (*Elytroderma deformans*) in ponderosa pine were reported on the Flathead Indian Reservation RA and although none was reported on the Bitterroot RA, significant acres are affected there as identified during site visits. Severe Elytroderma needle disease was found causing high levels of mortality in an 80+ year old ponderosa pine stand on the Cabinet District on the Kootenai NF. The trees were planted in the 1920's from Bitterroot stock, and are likely stressed from being planted off site (TR-05-05).

Dwarf Mistletoes

Unlike previous years, no suppression projects were funded for managing dwarf mistletoes on the National Forests. However, FHP suppression funds were used on the Blackfeet Indian Reservation for cleansing 200 acres of submerchantable dwarf mistletoe-infected trees after harvest and for pre-suppression surveys (TR-05-19). Pre-suppression survey results were surprising due to low numbers of visible infections after 30 years. Previous research suggests that 35% of susceptible trees within 30 feet of infected overstory trees can be expected to be infected after 30 years, while less than 5% were found to be infected during pre-suppression surveys of a 30 year old unit next to an infected overstory harvested this year. Even considering the infection level is an underestimate due to latent (not yet visible) infections and infections overlooked by surveyors, the proportion of infected trees is low.

Diplodia Shoot Blight, Western Gall Rust

Combined damage from Diplodia shoot blight and western gall rust continues to cause noticeable dieback of ponderosa pine shoots. Low levels of damage can currently be seen throughout western Montana. Moderate to severe damage occurs in certain locations.

Comandra Blister Rust

Topkill in larger ponderosa pine on the Bitterroot NF was noted in several site visits (TR-05-37). Such topkill appears to be common in the foothills of the Bitterroot and Sapphire Mountains and is attributed to comandra blister rust.

White Pine Blister Rust

In order to address issues involving performance and management of rust-resistant white pine, two-day workshops have been developed to update managers on the latest information regarding management of rust-resistant western white pine in the Inland Empire. Since 2003, more than 150 foresters from private industry, federal, and state agencies have attended these workshops and one workshop will be offered in the summer of 2006.

Pruning the lower branches of white pine has been found to double the survival of white pine in areas with high infection. A booklet with detailed pruning guidelines is currently being developed in cooperation with the University of Idaho Extension service, and a one-day pruning workshop is offered each summer.

As a result of a special monitoring methods workshop sponsored by the Whitebark Pine Ecosystem Foundation in June of 2004, standardized monitoring techniques are being used to establish plots throughout the West. A range-wide database is being developed to compile results of surveys in limber pine as well as whitebark pine.

Whitebark pines in the Greater Yellowstone ecosystem (including parts of Montana, Idaho, and Wyoming) are being monitored by US Forest Service, National Park Service, US Geological Survey, and Montana State University personnel. These long-term plots are designed to provide a statistically based assessment of the incidence of white pine blister rust in the ecosystem and the condition of whitebark pine. In 2004 and 2005 plots were established on parts of the Beaverhead, Custer, and Gallatin NFs in Montana. Data specific to these areas have not been analyzed, but preliminary results indicate that the proportion of live whitebark pine infected with wpbr in the GYE is 0.25 ± 0.031.

Stem Decays

The following decay-causing fungi were isolated during 2004 and early 2005 and identified by the Mycology Group at the Forest Products Laboratory in Madison, Wisconsin. The large number of isolates from western larch is due to support of a University of Montana graduate student who is investigating potential wildlife use of western larch and a separate study looking at the deterioration of fire-killed western larch. Approximately 9 additional isolates were collected in 2005, but have not been identified yet.

Isolate No.	Date Collected	Location	Host	Tree Part	Identification
040711	June 2004	Gallatin NF	Lodgepole pine	Root – heartwood	*Phellinus pini*
040712	May 2004	Lewis & Clark NF	Engelmann Spruce	Stem – heartwood	*Phellinus pini*
040713	May 2004	Lewis & Clark NF	Engelmann Spruce	Stem – heartwood	*Stereum sanguinolentum*
040715	May 2004	Lewis & Clark NF	Engelmann Spruce	Stem – heartwood	*Phellinus pini*
040717	May 2004	Lewis & Clark NF	Engelmann Spruce	Stump	*Phaeolus schweinitzii*
BE2-3#11A	2004	Flathead NF	Western larch	Stem – heartwood	*Stereum sanguinolentum*
BF4-1#6	2004	Flathead NF	Western larch	Stem – heartwood	*Stereum sanguinolentum*
BF6-4#1	2004	Flathead NF	Western larch	Stem – heartwood	*Echinodontium tinctorium*
BF11-3#11	2004	Flathead NF	Western larch	Stem – heartwood	*Stereum sanguinolentum*
BF8-3B#12	2004	Flathead NF	Western larch	Stem – heartwood	*Sistotrema brinkmannii*
BF12-13#3	2004	Flathead NF	Western larch	Stem – heartwood	*Sistotrema brinkmannii*
BF12-3#4	2004	Flathead NF	Western larch	Stem – heartwood	*Sistotrema brinkmannii*
BF12-3#13	2004	Flathead NF	Western larch	Stem – heartwood	*Antrodia serialis*
BF12-4#6	2004	Flathead NF	Western larch	Stem – heartwood	*Sistotrema brinkmannii*
050101	Sept. 2004	Flathead NF	Western larch	Stem – sapwood	*Fomitopsis pinicola*
050103	Sept. 2004	Flathead NF	Western larch	Stem – sapwood	*Fomitopsis pinicola*
050106	Sept. 2004	Flathead NF	Western larch	Stem – sapwood	*Fomitopsis pinicola*
050112	Sept. 2004	Flathead NF	Western larch	Stem – sapwood	*Fomitopsis pinicola*
050123	Sept. 2004	Flathead NF	Western larch	Stem – sapwood	*Stereum sanguinolentum*
050140	Sept.	Flathead NF	Western larch	Stem –	*Fomitopsis pinicola*

	2004			sapwood	
050143	Sept. 2004	Flathead NF	Western larch	Stem – heartwood	*Sistotrema brinkmannii*
050148	Sept. 2004	Flathead NF	Western larch	Stem – sapwood	*Fomitopsis pinicola*
050162	Sept. 2004	Flathead NF	Western larch	Stem – sapwood	*Fomitopsis pinicola*
050301 E1	Mar. 2005	Flathead NF	Engelmann Spruce	Stem – sapwood	*Stereum sanguinolentum*

Root Diseases

Root diseases change very little from one year to the next, so there is very little to highlight. Armillaria root disease was found to be causing mortality in larger ponderosa pine on the Three Rivers District of the Kootenai NF (TR-05-17). The ponderosa pine was mixed with Douglas-fir, which was also incurring significant mortality from Armillaria root disease.

Abiotic

Drought was identified on nearly 4,500 acres on the Flathead Indian Reservation RA; however, much of the area identified was defoliated by Douglas-fir tussock moth in previous years. Although the drought in recent years has probably affected the appearance of the trees, the recent defoliation is probably as important, or more so, than the effects of drought. Also high water damage was identified by ADS on 93 acres across the state. Much of the damage is associated with beaver dams and other obstructions to waterways.

ECOLOGY OF MAJOR DISEASES

Needle Diseases

Most fungi causing foliage diseases are confined to the needles and leaves, a few attack buds, and some invade young twigs. Foliage diseases are generally more severe in the lower canopy on seedlings, saplings, and small poles than on larger trees. Most of the fungi affect either foliage of the current season or older foliage, but rarely both; it is unusual for all the foliage in either category to be involved. The fungi vary in pathogenicity from year to year according to climatic conditions; heavy infection over a period of years is exceptional. Some trees in a stand are severely infected, but others escape with little or no infection, apparently because of individual resistance. Foliage diseases rarely cause mortality, but they do cause a reduction in growth.

Dwarf Mistletoes

Dwarf mistletoes (*Arceuthobium* spp.) are parasitic plants that extract water and nutrients from living conifer trees. The dwarf mistletoes are native components of western coniferous forests, having co-evolved with their hosts for millions of years. The different dwarf mistletoes are generally host specific. In Montana, lodgepole pine and western larch dwarf mistletoes occur throughout the range of their respective hosts while Douglas-fir dwarf mistletoe occurs only in the range of its host west of the Continental Divide.

Because dwarf mistletoes are obligate parasites, ecological forces that have patterned the development of the host tree species have also played roles in influencing the distribution of dwarf mistletoes across the landscape. Fire is one of those influential ecological forces. In general, any fire event that kills host trees will reduce the population of dwarf mistletoes, at least in the short term. With larger and more continuous fire disturbance, greater reductions in dwarf mistletoe populations can be expected at the landscape level. Large, complete burns will greatly reduce dwarf mistletoe populations across the landscape and may even eliminate small, localized populations. Small, “patchy” burns will temporarily reduce portions of dwarf mistletoe populations, but infected residuals

provide a ready source of dwarf mistletoe seeds for the infection of the newly developing regeneration.

Human influences, including fire suppression and logging, have also had effects on dwarf mistletoe population dynamics. Partial cutting—which created multi-storied stands—and fire suppression may have served to increase the severity of dwarf mistletoes relative to the "pre-settlement" condition. Conversely, dwarf mistletoes may have been reduced in certain age classes, habitat types, elevation zones or topographic positions that have been intensively managed. Fire suppression and cutting practices that have encouraged shifts in species compositions could have either increased or decreased the disease severity depending on what species of trees and dwarf mistletoes occurred on any given site.

The parasitic activity of dwarf mistletoes causes reduced tree diameter and height growth, decreased cone and seed production, direct tree mortality, or predisposition to other pathogens and insects. Western larch and Douglas-fir dwarf mistletoes have been estimated to cause average growth losses of 20 ft^3/acre/year in areas where they occur in Montana. Lodgepole pine dwarf mistletoe has been estimated to cause an average growth loss of 9 ft^3/acre/year in eastern Montana and 12 $ft.^3$/acre/year in western Montana. On the other hand, witches' brooms and tree mortality may result in greater structural diversity and increased animal habitat. Dwarf mistletoe flowers, shoots, and fruit are food for insects, birds, and mammals. Witches' brooms may be used for hiding, thermal cover, and nesting sites by birds and mammals. In the long term, heavily infested stands of the host trees can begin to decline, resulting in a successional shift toward other tree species.

Diplodia Shoot Blight and Western Gall Rust

Diplodia shoot blight and canker (also known as Sphaeropsis shoot blight) is caused by the fungus *Diplodia pinea*. The disease is seen mainly on ponderosa pine in Montana, but other species can be affected. Damage occurs on current year's growth in the spring as evidenced by needle stunting, discoloration, and shoot dieback. Needles turn a straw-like color, then red as the shoot dies and dries out. Resin droplets often exude from the base of infected needles. Cones are infected by the fungus and act as a source of inoculum each spring as spores are spread to new growth by rain-splash. Severity of infections on ponderosa pine varies. In the most susceptible trees, nearly all current-year shoots can be infected, and chronic infections can result in non-vigorous crowns and occasional top-kill. In less susceptible trees only scattered shoots are affected, while some ponderosa pine appear to be resistant and without visible infections. Patterns of infection within a tree's crown vary as well; there may be numerous dead shoots on one side of a tree and few if any on the other. Observations suggest that ponderosa pine along river bottoms and major drainages may have heavier levels of *Diplodia pinea* infection, perhaps due to airflow patterns or other environmental conditions.

Casually attributing shoot dieback on ponderosa pine to Diplodia shoot blight may lead to an incomplete or incorrect diagnosis. Informal surveys show that western gall rust infections are commonly present towards the ends of branches with shoot dieback. Western gall rust and Diplodia shoot blight can be present on the same branch. In fact, even small amounts of water stress increase damage caused by *Diplodia pinea*, and western gall rust infections may be causing stress in portions of the branch distal to even small rust galls.

White Pine Blister Rust

Since white pine blister rust was introduced to North America in 1910, it has spread throughout the range of our native 5-needle pines (western white pine, whitebark pine and limber pine). By the early 1960's impacts on the timber industry had been devastating, but the ecological impacts have been equally severe. This disease, along with bark beetles, fire suppression, and harvesting reduced

white pine dominated stands to less than 5% of the 5 million acres where it once was the dominant species. Residual mature white pine continues to be lost due to a combination of blister rust and mountain pine beetle, and blister rust may also kill a high proportion of naturally regenerated seedlings. This has resulted in major changes in historical transitions in forest types over broad areas. Western white pine has been replaced by species such as grand fir, Douglas-fir, and hemlock. These tree species are more susceptible to native disturbances such as bark beetles and root diseases.

Fortunately, low levels of natural resistance occur, and an intense breeding program was initiated in the 1950's for western white pine. This program is now producing seedlings with increased levels of resistance. These seedlings are planted operationally on suitable white pine sites on the Kootenai, Lolo, and Flathead National Forests, as well as the Stillwater and Swan State Forests in western Montana.

Although the improved stock is performing much better than natural regeneration, recent surveys have found that levels of infection in some areas are higher than expected, so several projects are currently underway to examine canker growth and girdling rates to help relate current infection levels with actual mortality over time (see Special Projects).

As the rust has moved into fragile high elevation ecosystems, the normal successional pathways of limber pine and whitebark pine have also been greatly altered. The recent outbreaks of mountain pine beetle have caused additional widespread mortality in many whitebark pine stands. Although mountain pine beetle is a native insect and has historically helped recycle pine stands, the combination of beetle-caused mortality with fire suppression and blister rust are raising concerns about the long-term viability of whitebark pine ecosystems. This has severe implications to watersheds and wildlife such as the grizzly bear and Clark's nutcracker.

Stem Decays

The main function of heartwood in live trees is to give individual trees vertical stability. The decay of heartwood weakens this vertical stability, making trees more susceptible to stem breakage. Stem breakage can lead to mortality and subsequent formation of small-scale canopy gaps. The main successional functions of heartwood stem decays are to move stands from a mature closed canopy to a more open canopy and to perpetuate an open canopy.

Heartwood decay fungi are also necessary for the formation of hollow trees, which are also important habitat for a number of animal species. Hollow trees are created when decay fungi invade the heartwood of a living tree. The decay may progress to the point that the cylinder of decayed heartwood eventually detaches from and slumps down, leaving a hollow chamber. The only way to obtain a hollow dead tree or log is to start with a living tree hollowed out by decay.

Sapwood decay fungi tend to invade dead trees or tree parts, such as dead branches and bark beetle strip attacked areas on stems. They are often associated with wood boring insects that can provide an entry site through the bark and may even carry the sapwood decay fungi into the wood. Some sapwood decay fungi will also consume heartwood.

Stem decays are important in the creation of wildlife habitat in living trees. Although primary cavity nesters are capable of excavating in sound wood, they selectively excavate in trees and snags with decayed wood. Most primary cavity nesters do not reuse their holes from one year to the next. Their previous year's holes are then used by a multitude of secondary cavity nesters, which are very dependent on already-created holes for successful reproduction. Thus, cavity-nesting habitat (decayed wood) is necessary for the successful reproduction of a number of animal species.

Root Diseases

Root diseases are the most significant disease agents of mortality and growth loss in Montana, mostly west of the Continental Divide. Because root diseases are diseases of the site, we see very little changes occurring from one year to the next. The most significant root diseases in Montana are Armillaria root disease (*Armillaria ostoyae* (Romagn.) Herink), laminated root disease (*Phellinus weirii* (Murr.) Gilb.), annosus root disease (*Heterobasidion annosum (*Fr.) Bref.), and brown cubical root and butt decay (*Phaeolus schweintizii* (Fr.) Pat.). The most susceptible tree species in Montana is Douglas-fir, with grand fir and subalpine fir taking a close second. The most tolerant species are western larch, pines and western red cedar, with the remaining species falling somewhere along the gradient between susceptible and tolerant. Although root diseases cause significant amounts of mortality and growth loss, they are also a major agent influencing both structure and species composition across landscapes. Root diseases have greatly influenced succession of vegetation in our forests. This is especially evident in the absence of natural fire cycles. On sites where there is a mixed species component with root disease tolerant serals, root diseases tend to prolong the seral stage on those sites. Root diseases slowly thin out the more root disease-susceptible species (Douglas-fir and true firs), and favor the root disease-tolerant serals.

On grand fir/subalpine fir climax habitats, with a Douglas-fir forest type, low levels of root disease will actually push the stand towards climax faster than in the absence of root disease. This is due to the greater susceptibility of Douglas-fir to root diseases. Although grand fir and subalpine fir are fairly susceptible to root diseases, they are measurably more tolerant than Douglas-fir. Root disease on western red cedar/western hemlock climax sites will also push stands towards climax by weeding out the more root disease susceptible seral species on these sites (Douglas-fir and grand fir).

On sites with a root disease susceptible forest type and climax habitat, very high levels of root disease will maintain early stand development. Root disease patches experience wave after wave of mortality as trees become large enough for their root systems to contact the inoculum on the site. Trees are unable to grow to a very large size before being killed by root disease.

Annosus root disease of ponderosa pine is less evident than the above root diseases, but very important in local areas. Annosus root disease has been found causing mortality in ponderosa pine plantations in various locations on the Darby RD, Bitterroot National Forest, private lands west of Kalispell, and continues to be a significant agent on the Flathead Indian Reservation.

COMPLEXES AND DECLINES

Aspen Decline and Mortality

Current aspen numbers in Montana are estimated at only one-third of historical numbers. Aspen mortality is probably underestimated during aerial detection surveys due to the lack of visible signatures associated with mortality in trees that die after an extended period of decline. Considering this underestimation, aerial detection surveys still reported a total of 670 acres of aspen, 100% of which were classified as either in decline or having leaf blight in 2005.

Aspen does not compete well in low-light environments and requires canopy-opening disturbances, such as fire, to regenerate. Without regeneration, stands of this short-lived tree species are expected to become decadent and deteriorate. Reductions of Montana aspen forests are believed to be largely due to fire suppression activities over the past 100 years; however, this supposition needs further investigation.

SPECIAL PROJECT

1. White Pine Blister Rust Canker Growth on F2 Stock

Over one hundred individual cankers on F2 stock have been tagged to monitor growth rates of cankers on improved stock. Each spring for the past 3 years, thumbtacks have been placed at the canker margin and annual growth rate for the prior year has been recorded. Most tagged cankers were originally branch cankers, and many have now killed the branch. However, most cankers continue to grow for several years even if there are no live needles remaining on the branch. This has also been reported for natural white pine and is extremely important to pruning programs where there may be a tendency to leave dead branches. Many cankers are now in the bole and will provide important mortality information in a few years. For additional information contact John Schwandt, CFO.

2. Abnormal Rust Cankers and Canker Girdling Rates in F2 Stock

A new study is looking at abnormal cankers on F2 stock. Cankers are classified as normal, abnormal or something in-between, and 50 trees of each type are being sectioned in a laboratory by an Oregon State University graduate student. Annual rings are used to determine rate of girdling to see if the visual characteristics of cankers can be reliably related to girdling rates. If some cankers have much slower girdling rates, it will help managers to predict eventual mortality of trees based on canker appearance. For additional information contact John Schwandt, CFO.

3. Monitoring Infection and Mortality Levels in White Pine Plantations

Permanent plots in seven white pine plantations were established in 1992; five in F2 plantations and two in F1 plantations. Natural regeneration as well as planted stock have been monitored for 12 years and infection and mortality levels of the improved stock have always been less than the natural regeneration. Infection levels after six years on the five F2 plantations varied from about 2% to over 35%, while the F1 plantations had over 40% infection. After another six years, infection in the F2 plantations was 28-60% and mortality was 7-46%. Infection in the two F1 plantations was nearly 90% and mortality was over 70% (See table). For additional information contact John Schwandt, CFO.

Change in Percent Infection and Mortality in Seven Plantations of Improved Stock over a 12- Year Interval

Stock Type	**Year Planted**	**Stand Name**	**% Infection 1992**	**1998**	**2004**	**% Mortality 1992**	**1998**	**2004**
F_2	1986	Copper 1	37.7%	49.7%	60.0%	10.3%	32.0%	46.3%
F_2	1986	Copper 2	11.5%	34.4%	45.9%	9.8%	18.0%	29.6%
F_2	1984	Copper 21	29.9%	42.7%	47.6%	13.4%	28.7%	38.4%
F_2	1989	Varnum 2	1.9%	14.2%	28.3%	0.0%	3.8%	7.5%
F_2	1988	Varnum 11	1.8%	36.0%	45.9%	1.8%	10.8%	45.0%
F_1	1988	Varnum 23a	43.1%	80.2%	88.8%	6.0%	61.2%	79.5%
F_1	1988	Varnum 23b	43.8%	83.8%	90.8%	19.2%	46.2%	71.5%

4. Whitebark Pine Restoration Pilot Project

Whitebark pine is a keystone species of many high elevation isolated stands. It is currently being lost due to a complex of mountain pine beetle killing mature trees, blister rust killing regeneration and cone bearing branches, fire suppression, and competition from other species. Over 80% of whitebark pine occurs in roadless areas, so restoration using seedlings may be logistically difficult. Therefore a project to determine the efficacy of planting whitebark seed has been submitted and a pilot project to test procedures was installed in November of 2005. This pilot project is testing warm stratification and seed scarification to see if germination can be improved over controls, and will also test two rodent repellants which may be crucial to seed survival. For additional information contact John Schwandt, CFO.

5. Whitebark Pine Rangewide Assessment and Restoration Plan

Forest health of whitebark pine is a concern from northern British Columbia to the Sierras in California, so we are compiling information regarding blister rust and bark beetle mortality throughout its range. This information will be used to help develop a restoration plan that will provide a variety of strategies to help improve whitebark pine survival in existing stands and encourage restoration in areas where it has been lost. For additional information contact John Schwandt, CFO.

6. Whitebark Pine and Limber Pine Database

Pathologists from Region 1 continued working with FHTET (the Forest Health Technology Enterprise Team) in Ft. Collins, Colorado to develop a database that will be the repository for survey data conducted on whitebark and limber pines. The database already includes many surveys and is expected to be operational in 2006. For additional information contact Blakey Lockman, MFO.

7. Evaluating the Effectiveness of Thinning Treatments on DFB-Caused Tree Mortality

A long-term thinning study in DF stands on the Helena, Lewis & Clark, and Bitterroot NFs was initiated in 2005, in cooperation with Jose Negron (RMRS), to evaluate effectiveness of two thinning treatments on DFB populations and associated tree mortality. Replicated treatments consist of (1) basal area reductions and (2) using stand density index (SDI) treatments to maintain or approximate uneven-aged stand conditions. Basal area reduction treatments will be included in ongoing projects on all three forests; SDI treatments will be evaluated on the Helena and Lewis & Clark NFs only. Evaluations are in varying phases dependent upon project status on each forest. Treatments were initiated in 2005. Implemented will be completed in 2006. Post-treatment evaluations will be conducted during 2006 and 2007, and at 5-year intervals thereafter. For additional information, contact Nancy Sturdevant, MFO.

8. Determining Area of Protection of DFB Pheromone-Baited Traps at Varying Beetle Population Densities

Three stands were selected on the Deerlodge NF and 2 on the Beaverhead NF that had outbreak DFB populations. Trap placements consisted of 3 sets of 3 Lindgren funnel traps randomly assigned in a triangular arrangement. Traps within clusters were 10 m apart and clusters 201 m apart. Traps were hung in mid-April, located in areas containing non-host trees or older mortality. Pheromone baits were replaced after 8 weeks.

We collected in excess of one million DFB from 4 sites on the Deerlodge NF and more than 800,000 from 4 sites on the Beaverhead NF. DFB-caused tree mortality was recorded on a 2-acre circular plot within the interior of the triangle formed by funnel trap clusters. A 100% survey of all trees was conducted within the plot to assess current beetle-caused mortality.

Data showed in 2004, there was a median 12% of the trees attacked on the Beaverhead untreated plots and 9% attacked on treated plots. Deerlodge plots had a median 21% attacked on treated plots and 7% attacked on untreated plots. In 2005, untreated Beaverhead plots had a median of 4% attacked and treated plots 6%. Untreated Deerlodge plots a median 5% attacked with 17% attacked on treated plots.

Pheromone traps can remove large numbers of beetles from infested areas. “Spill-over,” however may be unacceptably high in some stands; and trapping may have increased DFB populations in trapped areas. Because trap-out strategies may increase beetle activity; silvicultural manipulations, such as sanitation/salvage and hazard reduction, may also be necessary to reduce beetle-caused mortality to more acceptable levels. Contact Nancy Sturdevant, MFO, for additional information.

9. Can Pheromone Trap Catches Reduce DFB-Caused Mortality

Cooperative project with Kimberly Wallin (OSU, Corvallis, OR) in trying to determine how much DFB-caused mortality occurs around pheromone-baited funnel traps—and if trap placement affects mortality in adjacent DF stands. Ten pairs of traps, in 2 DFB population densities (moderate and high) placed in DF stands in southwestern Montana (Sula and Stevensville RDs, Bitterroot NF). DFB-infestation data were collected in August 2005. Trap catches and other data are being analyzed. For additional information, contact Ken Gibson, MFO.

10. Testing Efficacy of Verbenone Pouch in Reducing MPB-Caused Mortality in LPP

A project was established in LPP stands on the Butte RD, Beaverhead-Deerlodge NF, in an attempt to determine the efficacy of a new, experimental, 7.5-gram verbenone pouch in protecting trees from MPB attack. An additional treatment, the addition of hexanol pouches would also be assessed. In a randomly assigned treatment (by block) test, we selected three 1-acre plots in each of 6 blocks. Treatments consisted of no treatment (controls); 20, 7.5-gram pouches (Synergy Semiochemicals, Inc.) per acre; or 20, 7.5-gram verbenone pouches per acre, plus 20, 10-gram hexanol pouches per acre. Pouches were stapled to individual trees in a grid pattern (approximately ½-chain apart at 40/acre; about ¾-chain apart at 20/acre). A baited funnel trap was hung at the center of each plot. Stands were treated in late June and were to be evaluated in late September.

Unfortunately, the pouches were incorrectly applied. No treatment results were obtained. We hope to re-do the test, in similar stands in the same area in 2006. For additional information, contact Ken Gibson, MFO; or Sandy Kegley, CFO.

11. Testing Efficacy of Verbenone Pouch in Reducing MPB-Caused Mortality in Individual LPP

An individual-tree test, comprised of the same treatments as the area test, was conducted in LPP stands on Butte RD. One hundred fifty trees were selected in June. Fifty of each were treated with no pouches (controls); 2, 7.5-gram verbenone pouches per tree; and 1, 7.5-gram verbenone pouch and 1, 10-gram hexanol pouch per tree to test the efficacy of either treatment in reducing MPB-caused mortality in high-value trees. Trees were treated in late June. Those pouches were also applied incorrectly. We hope to conduct the test again in the same area, in 2006. For additional information, contact Ken Gibson, MFO; or Sandy Kegley, CFO.

12. Testing Efficacy of Masterline, Onyx, and Sevin in Protecting Individual LPP from MPB

In mid-June 2004, 150 LPP were selected as part of an evaluation of another potential replacement for Sevin (carbaryl) insecticide in protecting individual LPP from MPB attack. The insecticide under evaluation was Masterline (permethrin +C), a synthetic pyrethroid. In addition, we again evaluated the registered rate (0.06%) of Onyx (bifenthrin); and we applied 2% Sevin (carbaryl) as the “standard.” Control trees

were selected for both 2004 and 2005 (second-year protection). This project was under the direction of Chris Fettig, Research Entomologist, Pacific Southwest Research Station, Davis, CA.

Trees were selected on the Jefferson RD, Beaverhead-Deerlodge NF, east of Butte.

Groups of thirty trees each, comprised five treatments: 0.06% Onyx, 0.2% Masterline, 2% Sevin SL, check ('04), and check ('05). Trees were treated June 15-17, 2004 and evaluated in mid-September, following beetle flight. First-year results are shown in table below.

	Control	**Onyx**	**Masterline**	**Sevin**
Attacked	30	1	2	0
Not Attacked	0	29	28	30
% Mortality	100	3.4	6.7	0

Remaining live trees were re-baited in June 2005 and evaluated in September. Study indicated both Onyx and Masterline were effective for one year, but not a second. We also re-affirmed Sevin's effectiveness for 2 years. Results are shown below.

	Control	**Onyx**	**Masterline**	**Sevin**
Attacked	30	20	14	1
Not Attacked	8	8	13	29
% Mortality	73.3	71.4	51.8	3.3

For additional information, contact Ken Gibson, MFO.

COMMON AND SCIENTIFIC NAMES

Pathogens

Annosum root disease	*Heterobasidion annosum* (Fr.:Fr.) Bref.	Primary hosts: DF, GF, PP, SAF
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink	DF, GF, SAF, sapling pines
Black stain root disease	*Leptographium wageneri* (Kendrick) M.J. Wingfield	DF, PP
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.:Fr.) Pat.	DF
Dothistroma needle cast	*Dothistroma septospora* (Doroguine) Morelet	LP, PP, WWP, LPP, WBP
Dwarf mistletoes	*Arceuthobium* spp.	LPP, LP, DF, WL
Brown Stringy rot	*Echinodontium tinctorium* (Ell. & Ev.) Ell. & Ev.	GF, WH
Elytroderma needle cast	*Elytroderma deformans* (Weir) Darker	PP
Fusarium root rot	*Fusarium oxysporum* Schlechtend.:Fr.	DF (Nursery)
Grey mold	*Botrytis cinerea* Pers. Ex Fr.	WL (Nursery)
Laminated root rot	*Phellinus weirii* (Murrill) R.L. Gilbertson.	DF, GF, WH, SAF
Sirococcus tip blight	*Sirococcus conigenus* (DC.) P. Cannon & Minter	WWP (Nursery)
Sphaeropsis shoot blight	*Sphaeropsis sapinea* (Fr.:Fr.) Dyko & Sutton in Sutton	PP
Western gall rust	*Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	LPP, PP
White pine blister rust	*Cronartium ribicola* J.C. Fisch.	WWP, WBP, LP

Insects

Douglas-fir beetle	*Dendroctonus pseudotusugae* Hopkins	DF
Douglas-fir tussock moth	*Orygia pseudotsugata (*McDunnough*)*	DF, TF, ES
Gypsy moth	*Lymantria dispar (*Linaeus*)*	Most hardwoods
Mountain pine beetle	*Dendroctonus ponderosa* Hopkins	All pines
Pine engraver beetle	*Ips pini* (Say)	PP, LPP
Spruce beetle	*Dendroctonus rufipennis* Swaine	ES
Western balsam bark beetle	*Dryocoetes confuses* Swaine	SAF
Western spruce budworm	*Choristoneura occidentalis* Freeman	DF, TF, ES, WI
Western pine beetle	*Dendroctonus brevicomis* LeConte	PP
Fir engraver beetle	*Scolytis ventralis* LeConte	GF, SAF
Hemlock looper	*Lambdina fiscellaria lugubrosa* (Hulst)	DF
False hemlock looper	*Nepytia canosaria* (Walker)	DF

DF = Douglas-fir; GF = Grand fir; TF = True fir; SAF = Subalpine fir; PP = Ponderosa pine; LP = Limber pine: LPP = Lodgepole pine; WWP = Western white pine; ES = Engelmann spruce; WH = Western hemlock; WL = Western larch; WBP = Whitebark pine

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DIRECTORY OF PERSONNEL

Montana Department of Natural Resources and Conservation — Phone: (406) 542-4300

Bob Harrington	State Forester	bharrington@state.mt.us	4301
Rob Ethridge	Chief, Service Forestry Bureau	rethridge@state.mt.us	4303
Amy Kearney	Forest Pest Management Specialist	akearney@state.mt.us	4283
Brennan Ferguson	Contract Forest Pathologist	bferguson@state.mt.us	4288

Montana Department of Natural Resources and Conservation, Forestry Division
2705 Spurgin Road, Missoula, Montana 59804

◆

USDA Forest Service Regional Office — Phone: (406) 329-3308

Paul Ries[1]	Acting Director, S&PF	pries@fs.fed.us	(801) 625-5253
Patty Bates	Forest Health Monitoring Coordinator	pbates@fs.fed.us	(406) 329-3521
Janet Valle[1]	Pesticide Use Coordinator	jvalle@fs.fed.us	(801) 625-5258

USDA Forest Service, Northern Region, Federal Building,
200 East Broadway, P.O. Box 7669, Missoula, Montana 59807

[1] USDA Forest Service, 324 25th Street, Ogden, UT 84401

◆

USDA Forest Service Missoula Field Office — Phone: (406) 329-3308

Gregg DeNitto	Group Leader	gdenitto@fs.fed.us	3637
Leah Chapman	Entomologist	leahchapman@fs.fed.us	3298
Bill Cramer	Bio. Science Technician	wcramer@fs.fed.us	3130
Ken Gibson	Entomologist	kgibson@fs.fed.us	3278
Marcus Jackson	Plant Pathologist	mbjackson@fs.fed.us	3282
Blakey Lockman	Plant Pathologist	blockman@fs.fed.us	3180
Kjerstin Skov	Entomology, SCEP	kskov@fs.fed.us	3329
Jim Fears	GIS Coordinator	jfears@fs.fed.us	3289
Nancy Sturdevant	Entomologist	nsturdevant@fs.fed.us	3281
Larry Meyer	Bio. Science Technician, Aerial Survey	lmeyer@fs.fed.us	3136
Scott Sontag	Bio. Science Technician, Aerial Survey	ssontag@fs.fed.us	3323

USDA Forest Service, Northern Region, Federal Building,
200 East Broadway, P.O. Box 7669, Missoula, Montana 59807

DIRECTORY OF PERSONNEL, continued

USDA Forest Service Coeur d'Alene Field Office — *Phone:* (208) 765-7223

Jill Wilson	Group Leader	jwilson@fs.fed.us	7342
Sue Hagle[1]	Plant Pathologist	shagle@fs.fed.us	(208) 926-4356
Bob James	Plant Pathologist	rjames@fs.fed.us	7421
Sandy Kegley	Entomologist	skegley@fs.fed.us	7355
Carol Bell Randall	Entomologist	□randall@fs.fed.us	7343
John Schwandt	Plant Pathologist	jschwandt@fs.fed.us	7415
Doug Wulff	Bio. Science Technician	dwulff@fs.fed.us	7344
Holly Kearns	Pathology, SCEP	hkerns@fs.fed.us	7340
Lee Pederson	Entomologist	lpederson@fs.fed.us	7430

USDA Forest Service, Northern Region, Idaho Panhandle National Forests,
3815 Schreiber Way, Coeur d'Alene, Idaho 83814-8363

[1]USDA Forest Service, Lochsa Ranger District, Route 1,Box 398, Kooskia, ID 83539

Table 2. Acres of host type infested by bark beetles, 2000-2005

	2000[1]	2001	2002[3]	2003[3,4]	2004[5]	2005[3]
DFB[2]	34,401	82,273	60,203	76,035	92,395	168,515
ESB	213	637	6,232	9,539	311	1,911
IPS	11	17	498	4,784	16,283	12,783
WPB	368	670	739	834	369	1,714
FE	159	1,047	8,929	20,647	34,352	38,489
WBBB	28,010	27,622	112,024	76,035	133,780	208,552
MPB	40,758	111,626	261,348	305,911	453,292	817,745
Total	103,920	223,892	450,134	493,785	730,782	1,249,709

[1]Not all areas were flown in 2000 due to fires.

[2]DFB=Douglas-fir beetle; ESB= Spruce beetle; IPS=Pine engraver; WPB=Western pine beetle; FE=Fir engraver; WBBB=Western balsam bark beetle; MPB=Mountain pine beetle

[3]Includes Yellowstone NP acres in MT, ID and WY.

[4]Not all areas were flown in 2003 due to fires.

[5]Not all areas were flown in 2004 due to inclement weather.

Table 3. Douglas-fir beetle-infested acres and new dead trees in Montana, all ownerships, from 2002 through 2005

	2002		2003		2004		2005	
Reporting Area	**Acres**	**Trees**	**Acres**	**Trees**	**Acres**	**Trees**	**Acres**	**Trees**
Beaverhead	★	★	6,403*	13,840*	4,677*	10,784*	23,492	34,928
Bitterroot	3,463	6,073	34,442	31,989	30,990	61,534	69,342	142,708
Custer	11,755	24,676	27*	45*	64*	234*	4,314*	3,872*
Deerlodge	0*	0*	6,610	13,249	8,213*	26,078*	20,409	43,591
Flathead	2,405	3,563	5,580	8,552	5,754*	17,447*	13,457	27,719
Gallatin	7,164	16,924	5,649*	7,450*	4,515	12,669	9,520	21,200
Helena	2,374	4,293	1,817	3,560	10,810*	19,241*	5,553	8,670
Kootenai	1,204	2,103	10,924	14,134	9,108	21,054	5,403	11,891
Lewis & Clark	17,589	24,411	1,293	1,585	2,472*	5,473*	2,573*	5,770*
Lolo	457*	576*	1,143*	2,627*	8,084*	22,034*	10,439	30,915
Garnet	9,659	21,484	917*	1,637*	2,622	7,228	3,158	7,755
Flathead IR	111	541	14*	44*	1,718*	2,826*	200	414
Crow IR	1,691	2,598	0	0	0	0	49	113
Glacier NP	0	0	★	★	3,280*	5,123*	★	★
Yellowstone NP	15*	49*	1,135*	3,296*	★	★	350	862
Other	2,315	3,523	28	42	176	434	539	686
TOTAL	0	0	60,202	118,441	92,483	212,159	168,798	341,094

★ = Not surveyed Yellowstone includes acres in MT, ID and WY * = Partially surveyed

Table 4. Acres of mountain-pine-beetle-caused mortality on State and private lands in Montana from 2002 through 2005

	2002				2003				2004				2005			
Reporting Area	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP
Beaverhead	1,149	135	1,131	0	171*	95*	2,265*	0*	931*	24*	1,178*	0*	2,682	8	1,250	0
Bitterroot	45	519	0	0	0	532	0	0	10	372	0	0	596	87	0	0
Custer	2*	8*	0*	0*	0*	20*	0*	0*	23*	387*	34*	0*	9*	63*	0*	0*
Deerlodge	4,380	563	32	0	4,951	659	89	0	17,053*	55*	385*	0*	25,903	618	68	9
Flathead	2,062	185	39	76	3,735	1,266	236	12	3,891*	651*	801*	10*	9,804	190	0	0
Gallatin	19	0	0	0	336*	27*	561*	0*	148	12	6,971	0	42	0	1,354	0
Helena	103	2,394	0	0	1,465	1,522	0	0	1,509*	3,646*	1,163*	0*	2,099	1,237	1,000	0
Kootenai	2,315	81	0	74	860	79	0	71	106	14	0	245	164	0	12	0
Lewis & Clark	6*	592*	0*	0*	651*	4,202*	309*	0*	1,108*	3,822*	143*	0*	895*	2,678*	2*	0*
Lolo	7,333	1,131	44	27	5,305*	1,124*	478*	0*	8,542*	862*	0*	0*	13,761	1,593	75	0
Garnet	134	296	0	0	196*	377*	2*	0*	3,029	174	0	0	7,527	454	0	0
Crow IR	0	557	0	0	0	231	0	0	301	0	2	0	0	28	0	0
Fort Belknap IR	0	82	0	0	0	27	0	0	2	34	0	0	★	★	★	★
No. Cheyenne IR	0	16	0	0	★	★	★	★	0	10	0	0	0	4	0	0
Rocky Boys IR	0	399	0	0	465	51	0	0	60	68	0	0	387	191	0	0
Flathead IR	915	839	0	0	2,023*	923*	0*	0*	3,283*	275*	0*	0*	6,127	3,055	2	17
Other	0	0	0	0	0	0	0	0	13	0	418	0	14	32	0	0
Total	18,416	7,797	1,246	177	20,158	11,135	3,940	83	40,009	10,406	11,095	255	70,010	10,238	3,763	17

[1]LPP = Lodgepole pine; PP = ponderosa pine; WBP = whitebark pine; WWP = western white pine

★= Not surveyed * = Partially surveyed

Table 5. Acres of mountain-pine-beetle-caused mortality on all Federal ownership in Montana, from 2002 through 2005

	2002				2003				2004				2005			
Reporting Area	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP
Beaverhead	11,150	2,736	29,132	0	287*	1,933*	36,626*	0*	12,017*	109*	28,800*	0*	47,786	60	41,191	11
Bitterroot	1,028	836	6	0	74	524	78	0	17	592	68	21	12,118	415	7,199	2
Custer	36*	1,017*	0*	0*	0*	554*	533*	0*	61*	4,645*	1,728*	0*	728*	545*	1,087*	0*
Deerlodge	21,212	246	388	36	24,976	1,207	336	0	89,655*	20*	936*	0*	156,312	1,208	2,007	0
Flathead	17,986	435	429	412	17,583	66	1,574	73	32,197*	16*	1,615*	8*	51,766	108	612	0
Gallatin	128	0	0	0	138*	8,452*	0*	0*	266	5	40,873	0	109	0	18,962	0
Helena	271	1,499	0	0	6,231	2,639	345	0	3,492*	2,894*	6,658*	41*	11,207	793	7,607	0
Kootenai	2,965	603	2	898	4,000	187	0	903	665	101	1,524	2,769	11,604	2	7,102	1,700
Lewis & Clark	10*	1,483*	0*	0*	605*	7,603*	4,389*	19*	4,437*	10,253*	8,289*	0*	4,404*	5,648*	6,539*	0*
Lolo	100,475	3,068	718	149	88,755*	4,155*	2,332*	6*	75,338*	2,092*	287*	0*	190,601	3,839	7,710	15
Blackfeet IR	★	★	★	★	★	★	★	★	16	0	4	0	★	★	★	★
Crow IR	35	776	21	0	0	523	0	0	33	899	9	0	104	115	0	0
Fort Belknap IR	8	428	0	0	53	100	0	0	39	122	0	0	★	★	★	★
Flathead IR	16,025	2,887	6	0	26,237*	3,522*	0*	0*	49,485*	3,016*	222*	0*	84,461	12,075	1,293	0
No. Cheyenne IR	0	703	0	0	★	★	★	★	0	654	0	0	0	171	0	0
Rocky Boys IR	0	465	0	0	0	0	0	0	96	20	0	0	548	141	0	0
Garnet	26	232	0	0	162*	81*	2*	0*	2,276	23	2	0	4,417	124	0	0
Glacier NP	91*	0*	0*	0*	★	★	★	★	536*	0*	79*	0*	★	★	★	★
Yellowstone NP	606	20	11,814	0	693*	0*	15,086*	0*	★	★	★	★	1,316	0	29,214	0
Total	172,050	17,434	42,516	1,495	169,794	31,546	61,301	1,001	270,626	25,461	91,094	2,839	577,481	25,244	13,523	1,728

[1]LPP = Lodgepole pine; PP = ponderosa pine; WBP = whitebark pine; WWP = western white pine ★ = Not surveyed * = Partially surveyed

Yellowstone includes MT, ID and WY acres

Table 6. Bark-beetle-infested acres (other than mountain pine beetle and Douglas-fir beetle) in Montana, all ownerships, 2002-2005

	Engelmann Spruce Beetle				Pine Engraver Beetle				Western Pine Beetle				Fir Engraver Beetle				Western Balsam Bark Beetle			
Reporting Area	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005
Beaverhead	42	8*	0*	0	14	0*	0*	33	0	14*	0*	0	10	0*	0*	58	67,669	14,437*	21,175	81,888
Bitterroot	4	10	0	55	0	0	85	2,336	95	55	21	0	6	34	40	0	515	873	1,101	26,088
Custer	0*	2*	0*	0*	0*	2,841*	929*	6,168*	0*	0*	0*	0*	0*	0*	0*	0*	972*	3,269*	4,901	4,216*
Deerlodge	22	8	14*	0	2	28	0*	272	0	58	8*	1,532	32	41	0*	0	2,187	4,632	3,929	6,276
Flathead	93	8	73*	31	0	25	36*	790	57	0	10*	0	8,126	16,109	20,592*	22,439	5,377	13,814	18,680	22,222
Gallatin	0	728*	13	6	0	0*	0	0	0	0*	0	0	0	0*	0	0	14,896	14,723*	48,091	26,567
Helena	2	29	0*	0	0	22	0*	470	0	32	2*	0	0	6	0*	0	93	6,348	3,281	3,387
Kootenai	10	0	0	8	0	0	252	11	164	97	173	45	132	3,008	9,112	7,702	5,120	2,628	5,696	12,463
Lewis & Clark	0*	0*	95*	0*	0*	2*	151*	0*	0*	0*	12*	0*	0*	0*	22*	0*	164*	6,690*	9,725	4,518*
Lolo	8	4*	0*	9	3	0*	141*	19	275	534*	69*	135	295	1,444*	39*	2,688	728	1,280*	3,285	2,559
Garnet	0	2*	2	0	0	0*	31	108	69	30*	75	2	0	6*	0	0	10	236*	283	444
Flathead IR	0	0*	14*	0	4	1,791*	14,165*	0	79	13*	0*	0	302	0*	287*	5,602	113	10*	2,578	5,933
No. Cheyenne IR	0	★	0	0	441	★	445	2,186	0	★	0	0	0	★	0	0	0	★	0	0
Fort Belknap IR	0	0	0	★	0	0	0	★	0	0	0	★	0	0	0	★	0	0	0	★
Rocky Boys IR	0	0	0	0	0	0	42	0	0	0	0	0	0	0	0	0	0	0	0	2
Crow IR	0	0	0	0	0	68	0	393	0	0	0	0	0	0	0	0	60	101	339	331
Blackfeet IR	★	★	2	★	★	★	6	★	★	★	0	★	★	★	2	★	★	★	2,572	★
Glacier NP	0*	★	96*	★	0*	★	2*	★	0*	★	0*	★	0*	★	4,218*	★	0*	★	8,208	★
Yellowstone NP	6,049	8,748*	★	1,802	32	0*	★	0	0	0*	★	0	21	0*	★	0	14,120	6,394*	★	11,678
Total	6,230	9,547	309	1,911	496	4,777	16,285	12,786	739	833	370	1,714	8,924	20,648	34,312	38,489	112,024	75,435	133,781	208,572

★ = Not surveyed * = Partially surveyed Yellowstone includes both MT, ID and WY acres

Figure 1. Reporting area boundaries in Montana

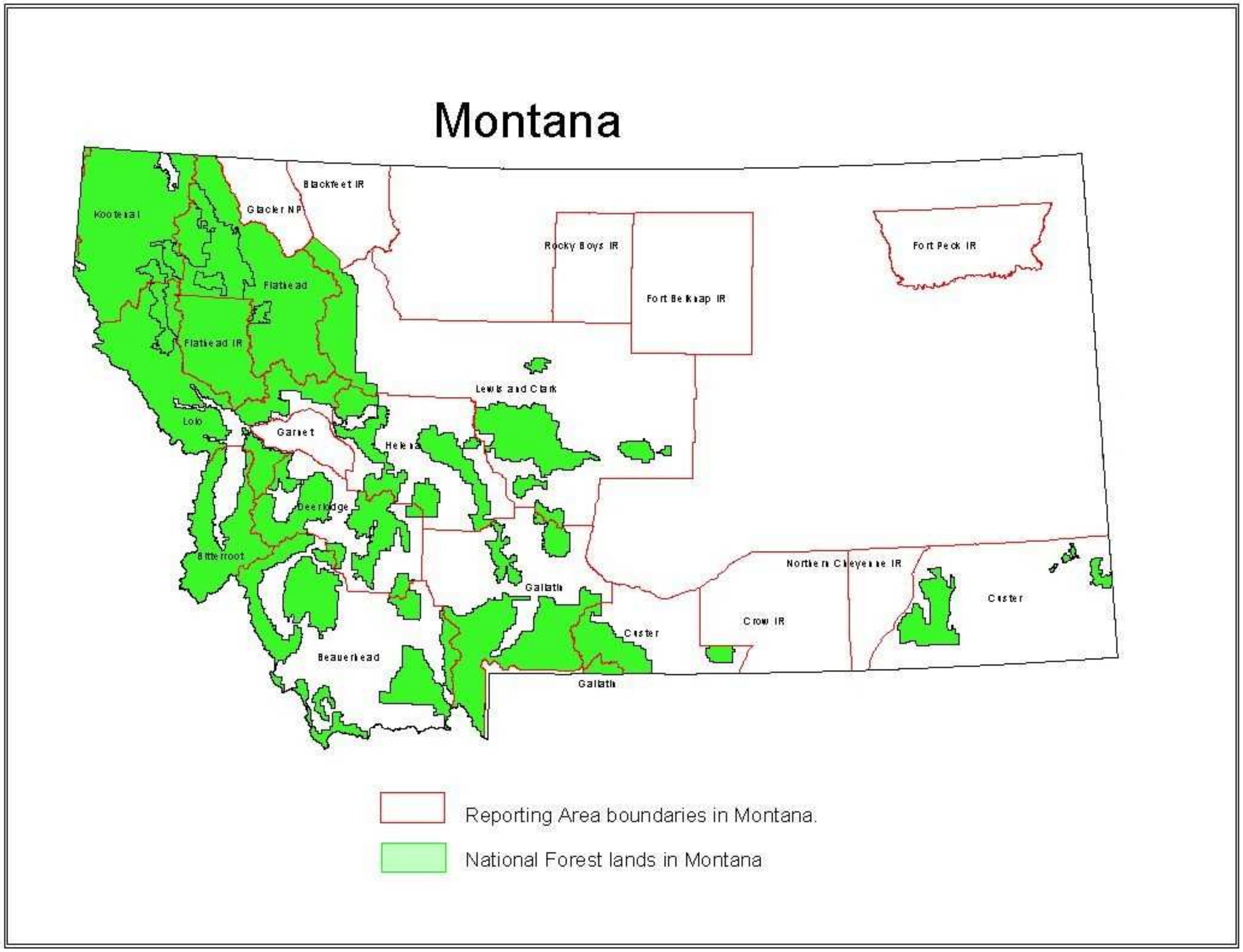

Figure 2. Area Surveyed During the Forest Health Protection Aerial Detection Survey in Montana, 2005

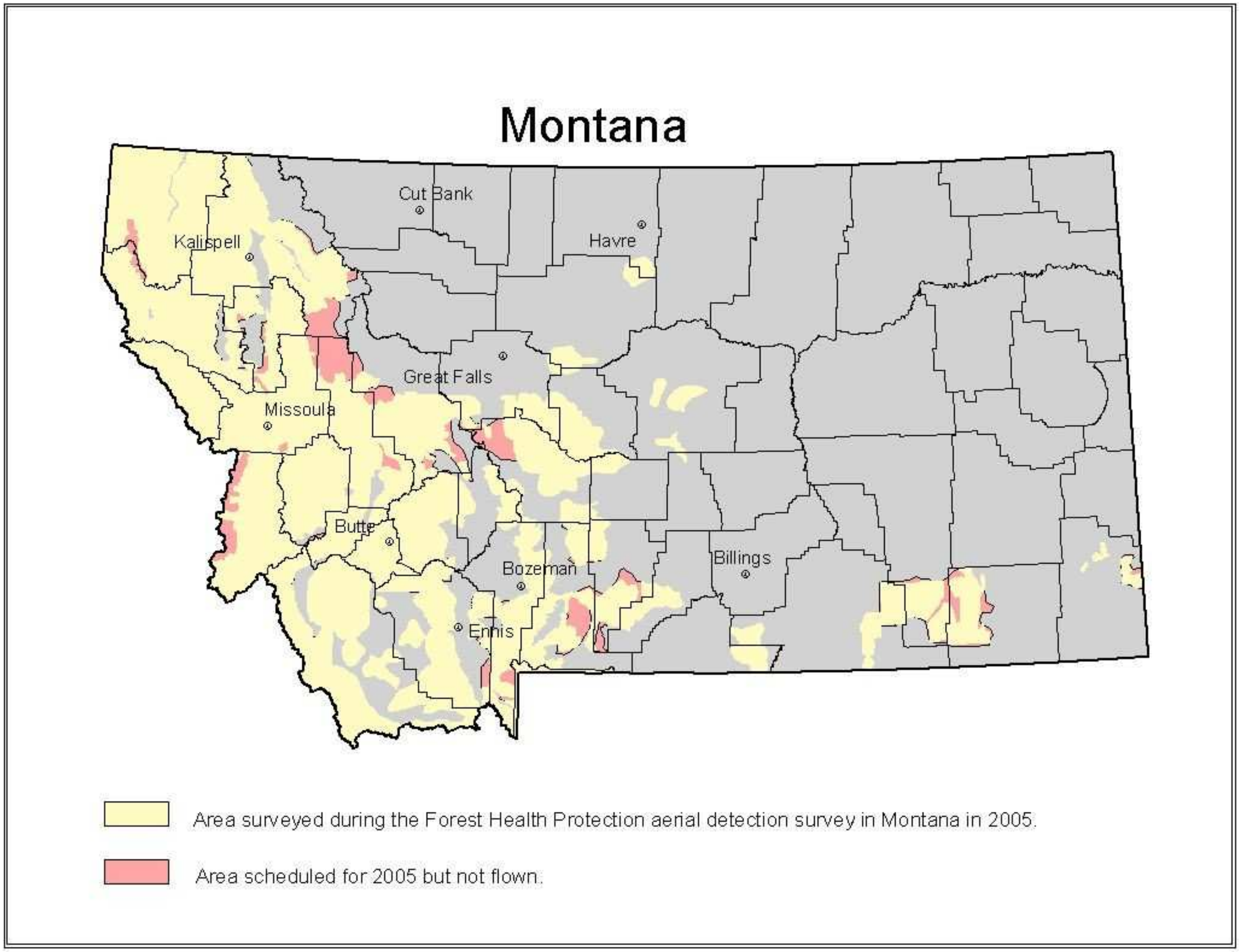

Figure 3. Mountain Pine Beetle Infestations in Montana, 2005

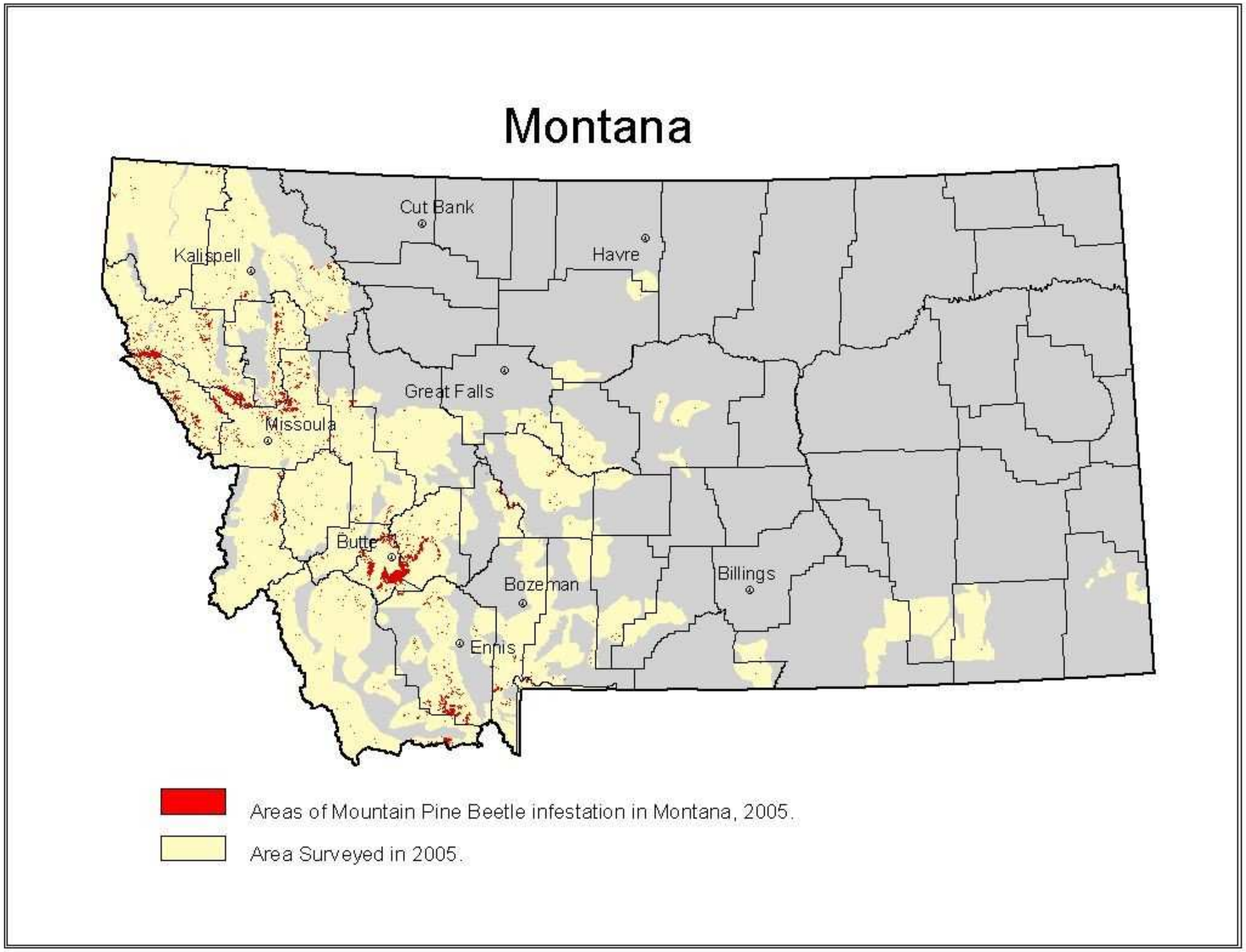

Figure 4. Douglas-fir Beetle Infestations in Montana, 2005

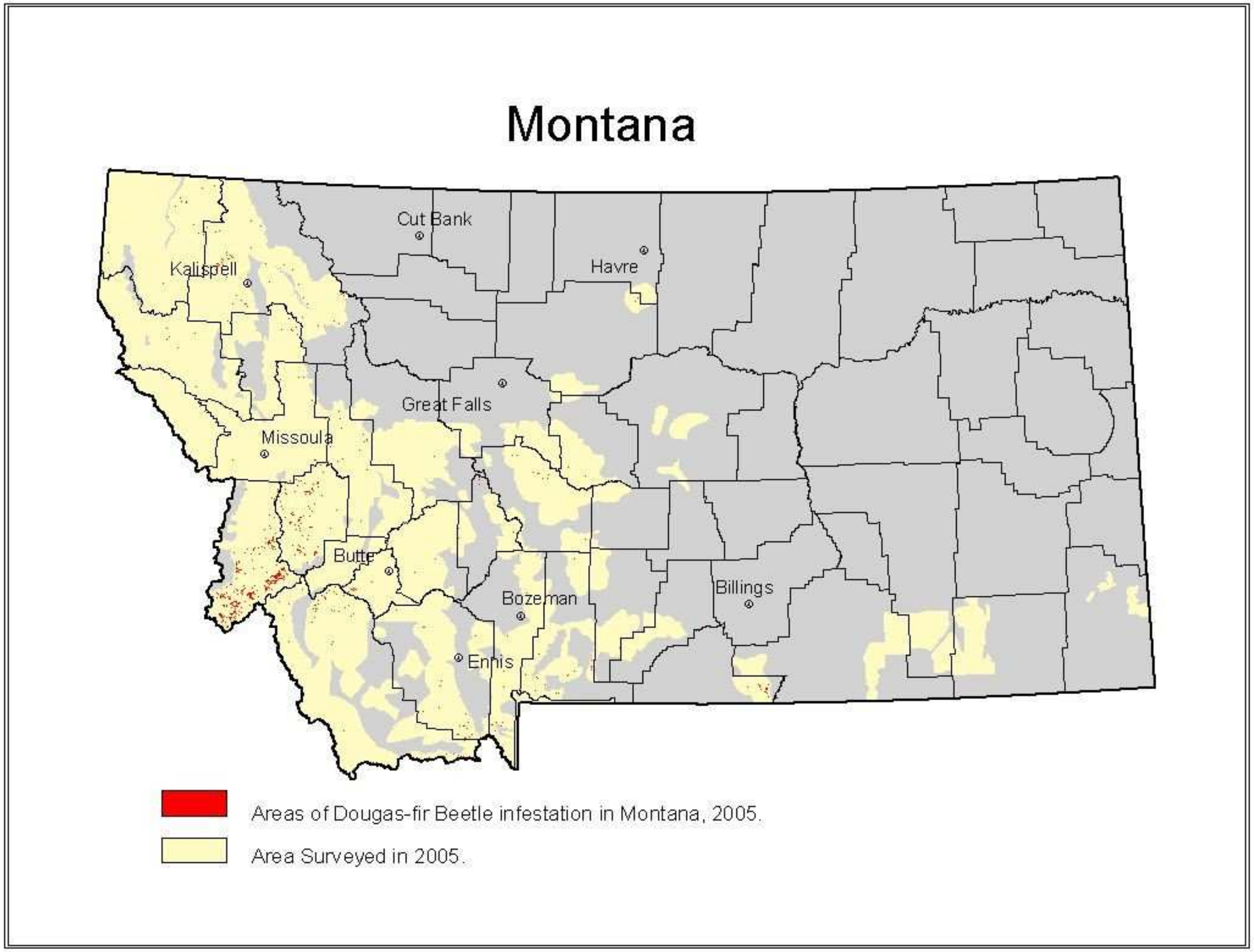

Figure 5. Fir Engraver Infestations in Montana, 2005

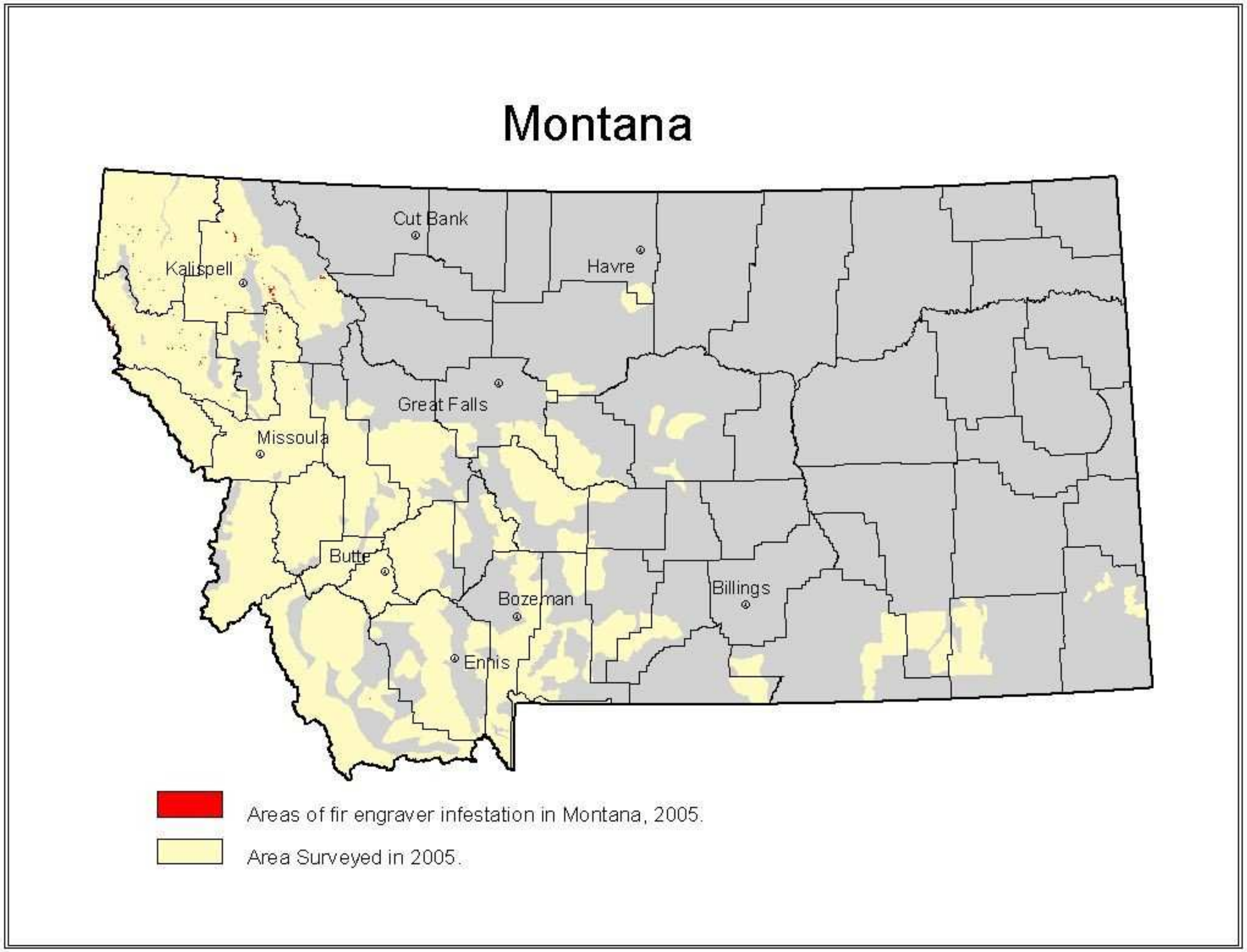

Figure 6. Western Balsam Bark Beetle Infestations in Montana, 2005

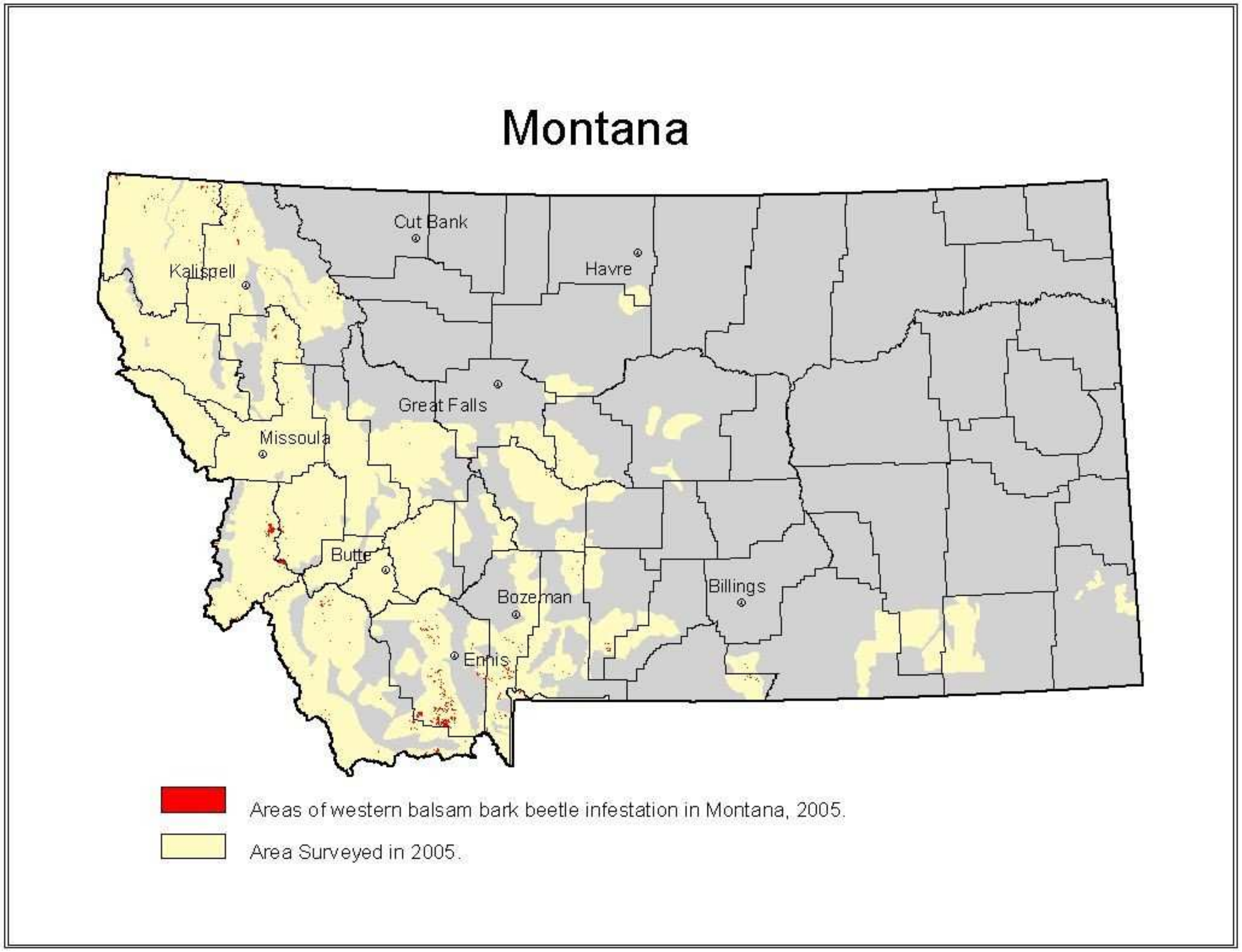

Figure 7. Western Spruce Budworm Infestations in Montana, 2005